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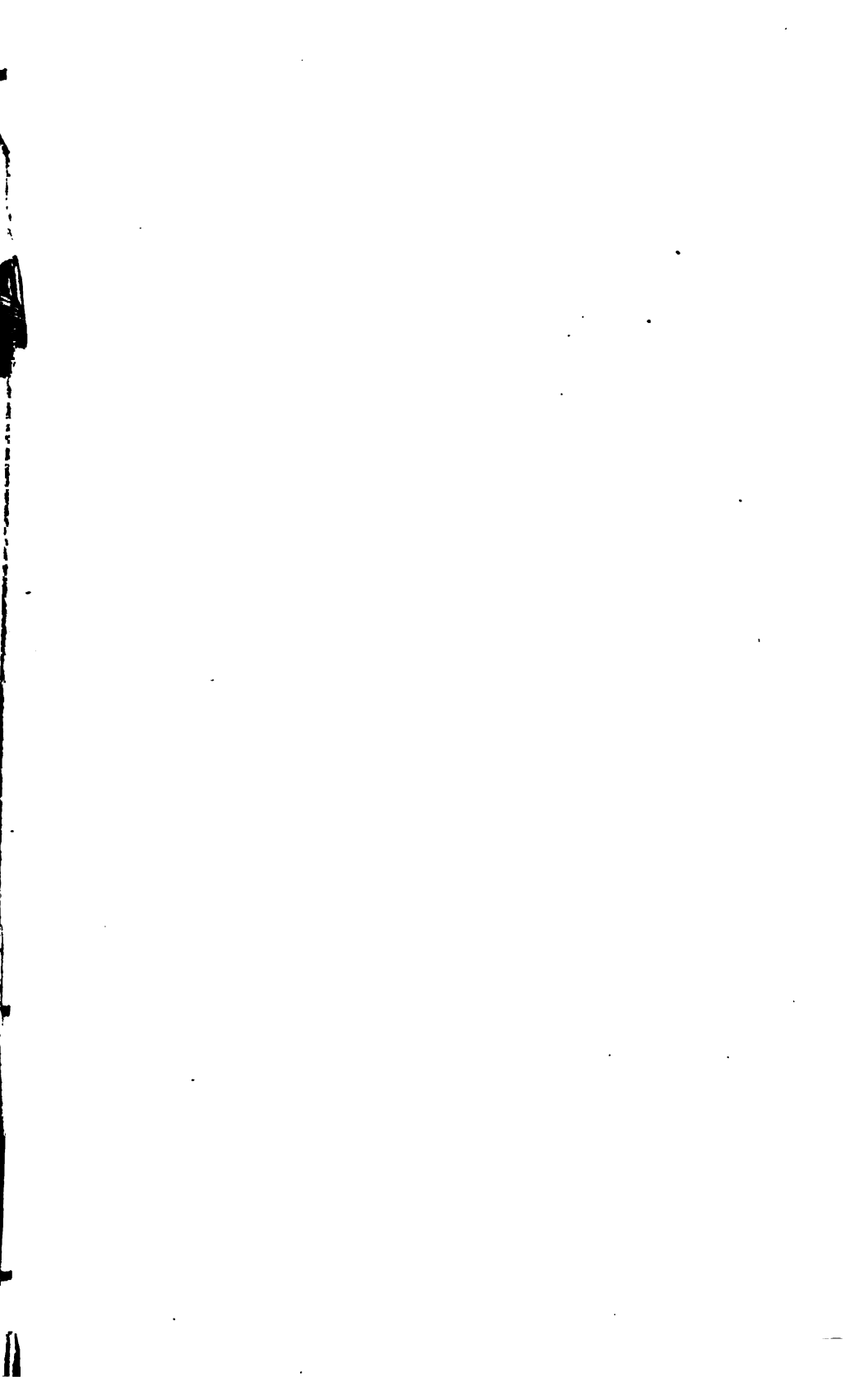
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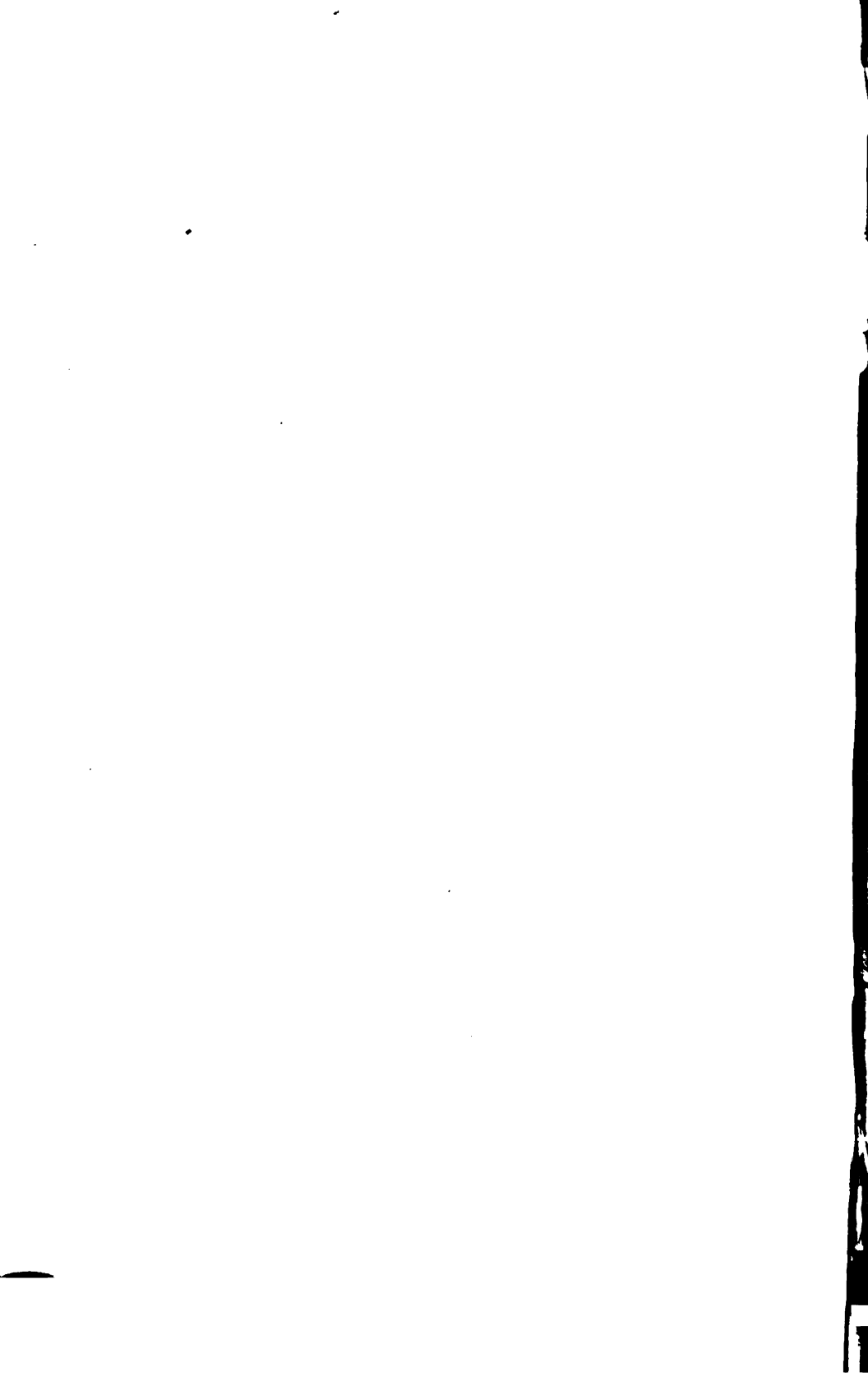
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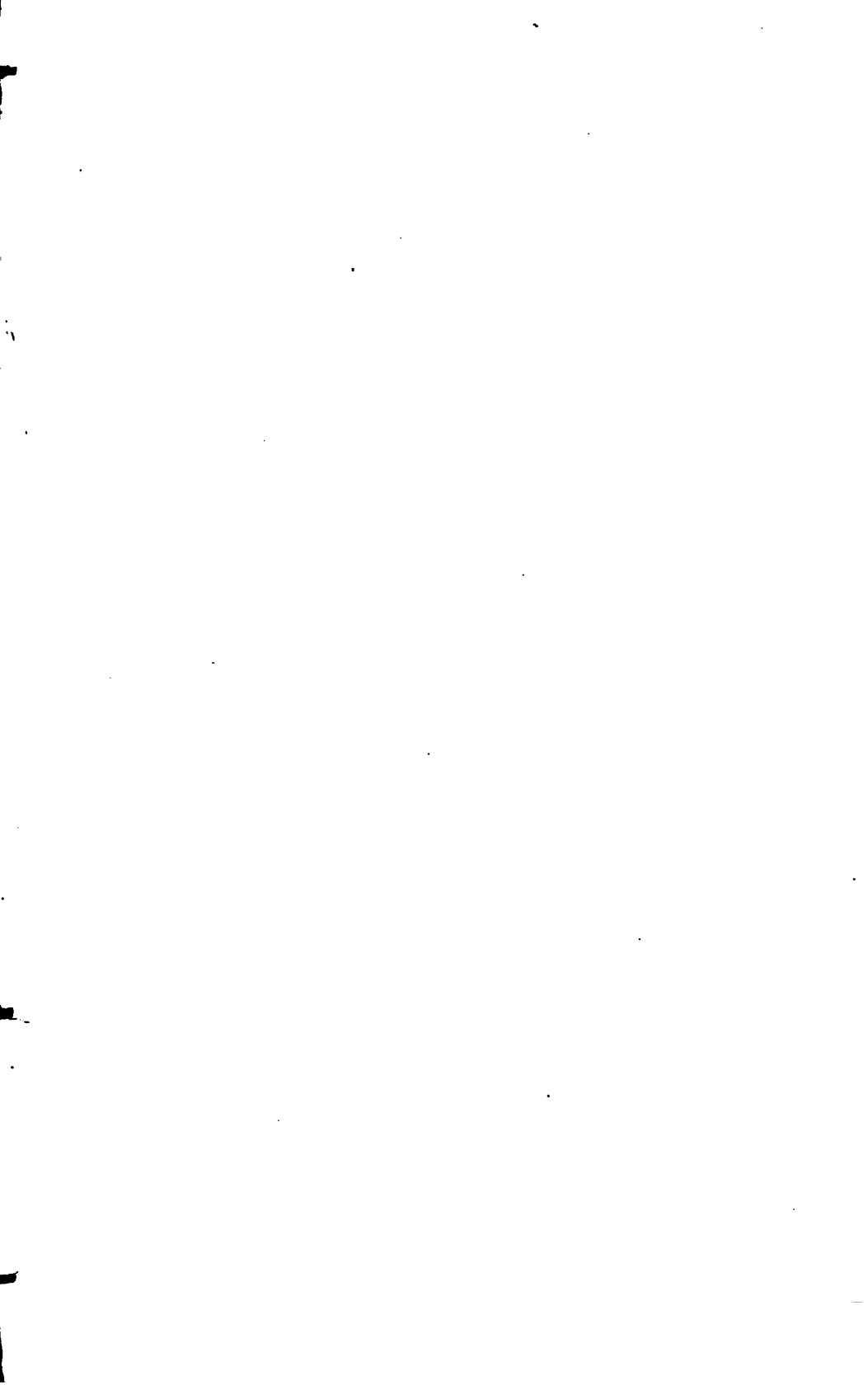
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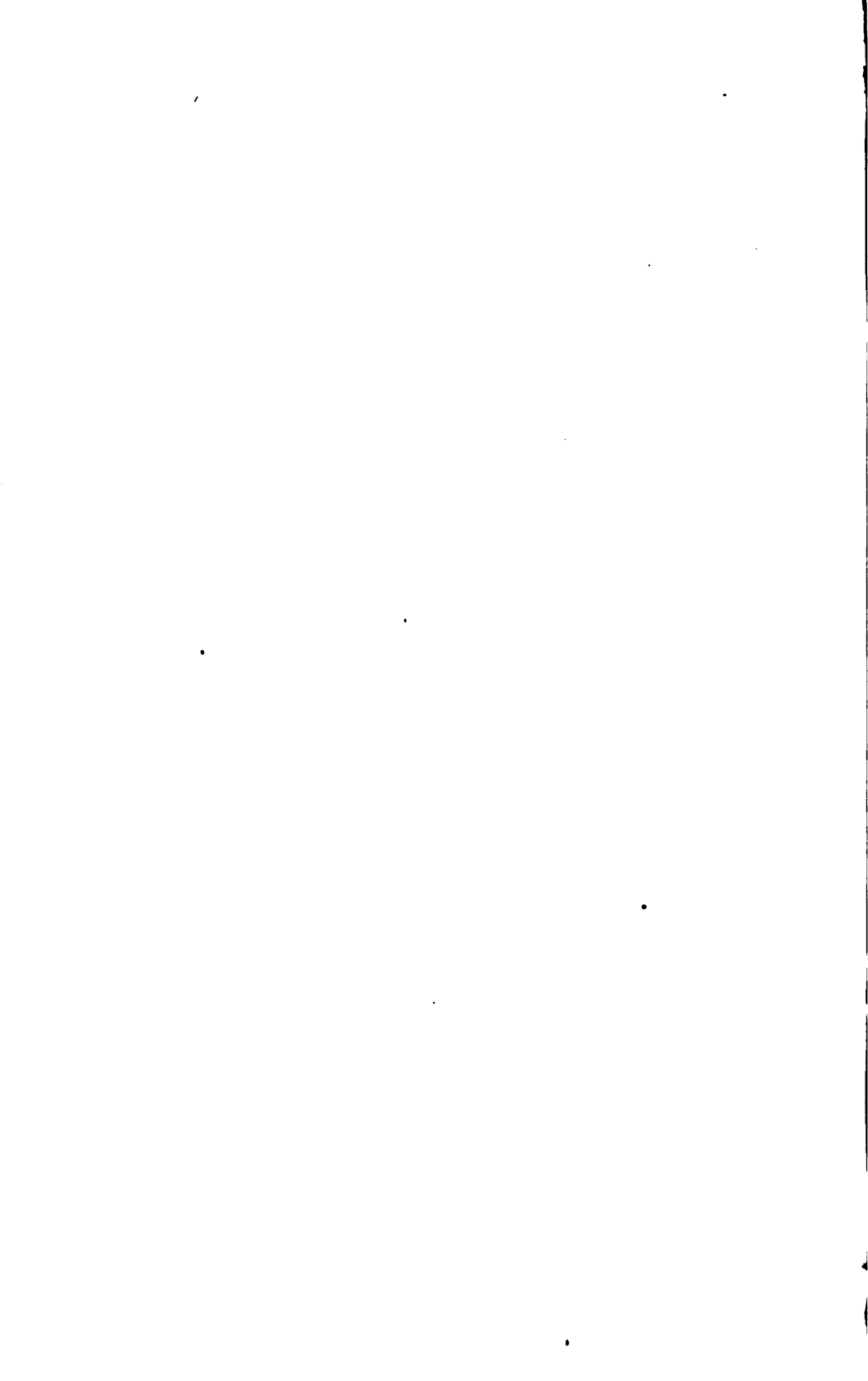






REPORT
OF THE
TESTS OF METALS
AND
OTHER MATERIALS
FOR
INDUSTRIAL PURPOSES
MADE WITH THE
UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL,
MASSACHUSETTS,
DURING
THE FISCAL YEAR ENDED JUNE 30, 1896.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1897.



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LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes," made by the United States testing machine during the year ending June 30, 1896.

WAR DEPARTMENT,

Washington, D. C., December 14, 1896.

SIR: I have the honor to transmit herewith, as required by law, the report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes," made by the United States testing machine during the fiscal year ended June 30, 1896.

Very respectfully,

DANIEL S. LAMONT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WATERTOWN ARSENAL,

Watertown, Mass., December 3, 1896.

SIR: I have the honor to submit herewith the following report of tests of metals, etc., made at this arsenal during the fiscal year ending June 30, 1896, in compliance with the requirements of law:

The total number of specimens tested during the year was 2,070, classified as follows:

Gun specimens.....	105
For Ordnance Department.....	293
For other Government Departments.....	352
Investigative tests.....	236
Tests for private parties.....	1,084
Total.....	2,070

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work.....	\$10,000.00
Received from private parties during the year.....	1,148.33
	11,148.33
Total received.....	11,148.33
	9,890.25
Amount expended for service and labor.....	9,890.25
Amount expended for light, power, and tools, implements and materials for test.....	1,258.08
	11,148.33
Total expended.....	11,148.33

As in preceding years, the work of the testing machine has consisted of the test and examination of material representing the current work of the Ordnance Department and material from other departments of the Government, work of an investigative nature on the physical properties of constructive material, and the tests of material for private parties who have had tests made on the testing machine as provided for by law.

The tests made for the Ordnance Department include specimens representing metal used in the construction of seacoast guns, in the manufacture of small arms, and the construction of disappearing gun carriages.

For the latter work there were also proof stresses applied to piston and suspension rods.

Small-arms rifle barrels were examined after modified methods of treatment in heating for rolling the barrels.

There were specimens for mechanical tests, and a large number of samples for chemical analysis from the material used in the construction of the Rock Island Bridge.

Tests of cast iron and bronze from the arsenal foundry have been made, showing the quality of metal used in projectiles and carriage work in process of construction at this arsenal, and the material furnished other arsenals.

Helical springs for 7-inch and 12-inch mortar carriages were tested.

Copper cylinders for use in crusher gauges were initially compressed, and tables for their use prepared.

For other departments of the Government, chain cable and chain iron was tested for the Bureau of Equipment, Navy Department; a gas tube for the Signal Service, War Department, and shot lines for the Life-Saving Service, Treasury Department.

The resistance of banded shell in the bore of rifle guns was made the subject of experimental inquiry. Tests were made with 3.2-inch steel B. L. rifled field pieces, a 5-inch B. L. steel siege rifle, a 7-inch B. L. steel siege howitzer, and 8-inch and 10-inch steel B. L. rifles.

The experiments showed the resistance of the bands when forcing the shells through the bores of the guns.

Observations were made at frequent intervals, hence the details of the tests and the diagrams show the curves of resistance at different parts of the bore.

A crest of high resistance was met in the first inch of travel, or while the band was taking the form of the rifling, and again a high resistance was met when the band on the projectile reached the end of the forcing cone, in guns having this feature.

From this point there was a gradual decline in resistance while the projectile traveled along the bore, although the resistance still remained of considerable magnitude throughout the tests.

Modifications were made in the shape of bands, and their resistances were then determined. A reduction in the amount of metal in the band displaced by the lands results in a reduction in resistance.

The expediency of a reduction in cross-sectional area of the band proportioned to the weight of the projectiles to obtain less resistance in the guns would necessarily require for solution some observations made in firing. These results are important and instructive for comparative purposes.

The interval of time in which deformation of the band takes place in the gun presents a phase of the question not covered by the present experiments.

In the test of the 7-inch howitzer there were observations made on the influence of the rate of travel of the shell, and in that experiment it was found that a resistance of 70,000 pounds could be maintained under a comparatively rapid speed for the testing machine, or that at a slower rate of travel the resistance could at will be maintained at 60,000 pounds.

There were other instances in which varying the speed within the limits permitted by the testing machine did not result in material difference in the resistance of the band.

The condition of the rifling, the smoothness of the lands and grooves, exerts a marked influence on the resistance of the band at the experimental rate of speed.

The high resistance of the 3.2-inch gun fouled by means of three blank cartridges further shows the influence of the condition of the bore on the band resistance.

There were riveted-joint tests representing the types of joints used in steam boilers where great strength is required. These tests are accompanied by complete micrometer observations showing their behavior under different loads. Other tests were made on riveted and bolted joints.

In the class of building material additional tests were made on the elastic properties of bricks.

Their moduli of elasticity and the ratios of lateral to direct strains were determined, their coefficients of expansion, absorption of water, and the expansion due to freezing while saturated with water.

Culvert pipes were tested by compression loads between wooden cushions placed on opposite sides of the exterior cylindrical surface of each.

There were compression tests of posts of Douglas fir and white-oak wood.

Tests of the former also include tensile tests and moduli of elasticity determinations under tension loads applied parallel to the grain, also compression loads applied parallel to the grain, and crosswise to the grain both radially and tangentially with reference to the position of the stick in the tree.

Tests on cordage were resumed, the purpose being to carry out a series of tests which shall comprise the commercial sizes of cordage of different fibers, and establish, according to present practice in rope making, the relation which exists between rope of different sizes.

In addition to the plain tensile tests the elongations were measured, and resilience determined as loads were released.

A number of short pieces were cut off several sizes of rope, the ends squared, and then the samples were unlaidd.

The lengths of the strands were measured, and after which the individual yarns composing a strand.

In this manner the variations in length of the component parts of the ropes were ascertained.

Further tests in this series will be included in the report of 1897.

During the fiscal year passed, much has been done in improving the condition of the testing building and in the arrangement of accessory tools.

The interior of the main testing laboratory has been renovated, the steam engine, pump, rotating apparatus, and machine tools for the preparation of specimens have been located in a separate room, removing all running machinery from the main laboratory.

The modifications in hydraulic piping, made necessary by these changes, have been completed.

A room has been provided for the preservation of interesting specimens. The chemical laboratory has been located and refitted in the second story of an adjacent building, the lower story being used for storage purposes.

To Mr. J. E. Howard, C. E., who has had charge of the testing machine since it was first set up, acknowledgment is due for accurate and faithful work, and for the scope of the investigative tests. His labors are invaluable to the Government.

Very respectfully, your obedient servant,

J. W. REILLY,

Major, Ordnance Department U. S. A., Commanding.

The CHIEF OF ORDNANCE, U. S. A.,
Washington, D. C.

REPORT
OF THE
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FOR
INDUSTRIAL PURPOSES
MADE WITH THE
UNITED STATES TESTING MACHINE AT WATERTOWN
ARSENAL, MASSACHUSETTS,
DURING THE
FISCAL YEAR ENDED JUNE 30, 1896.



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10-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.



TUBE No. 17.

No. 5379.

Marks, ^{10 B, T}_{B T, O}

Diameter, ¹⁰"/.564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1 000	0.	0.	0.	0.	Initial load.
1, 250	5 000	.000133	.000133	0.	-----	
2, 500	10 000	.000267	.000134	-----	-----	
5, 000	20 000	.000500	.000333	-----	-----	
7, 500	30 000	.000833	.000833	-----	-----	
8, 750	35 000	.001100	.001167	0.	-----	
10, 000	40 000	.001300	.002000	.000633	.000633	
10, 250	41 000	.001367	.002067	-----	-----	
10, 500	42 000	.001467	.002100	-----	-----	
10, 750	43 000	.001533	.002066	-----	-----	
11, 000	44 000	.001600	.002067	-----	-----	
11, 250	45 000	.001667	.002067	-----	-----	
11, 500	46 000	.001667	.002200	-----	-----	
11, 750	47 000	.002100	.002233	-----	-----	
12, 000	48 000	.002733	.002633	-----	-----	
12, 250	49 000	.003267	.002634	-----	-----	
12, 500	50 000	.004600	.001333	-----	-----	
19, 890	79, 580	.0433	.0387	-----	-----	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	79, 580
Elastic limit per square inch of original section	do...	45, 000
Elongation per inch after rupture	inch..	.0433
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.014
Reduction in area after rupture, per cent of original section	do...	4.8
Position of rupture	''	2 from neck
Character of broken surface		granular, radiating from a dull spot at the circumference
Elongation of inch sections	''	.06", ".03", ".04

TUBE No. 17.

No. 5380.

Marks, ^{10 R, T}_{M T, O}

Diameter, ¹¹/₁₆.564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....
2,500	10,000	.000233	.000166	.....	.....
5,000	20,000	.000567	.000334	.....	.....
7,500	30,000	.000900	.000333	.....	.....
8,750	35,000	.001033	.000133	0.	.....
10,000	40,000	.001267	.000234	0.	.....
10,250	41,000	.001300	.000033	.....	.....
10,500	42,000	.001333	.000033	.....	.....
10,750	43,000	.001367	.000034	.....	.....
11,000	44,000	.001400	.000033	.....	.....
11,250	45,000	.001433	.000033	.....	.....
11,500	46,000	.001567	.000134	.....	.....
11,750	47,000	.001633	.000066	.....	.....
12,000	48,000	.001667	.000034	Elastic limit.
12,250	49,000	.001967	.000300	.....	.....
12,500	50,000	.004000	.002033	.....	.....
12,750	51,000	.005700	.001700	.....	.....
13,000	52,000	.006500	.000800	.....	.....
13,250	53,000	.007633	.001133	.....	.....
21,190	84,760	.1433	.135667	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,760
Elastic limit, per square inch of original section	do..	48,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do..	.001667
Reduction in diameter at point of rupture	do..	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture	"	.14 from neck
Character of broken surface		silky
Elongation of inch sections	"	.32", ".22", ".11

TUBE NO. 18.

No. 5381.

Marks, ^{10 R_u T}_{B T, 0}

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....
2,500	10,000	.000300	.000200	.....	.....
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.000967	.000334	.....	.....
8,750	35,000	.001133	.000166	0.	.....
10,000	40,000	.001300	.000167	0.	.....
10,250	41,000	.001333	.000083	.....	.....
10,500	42,000	.001367	.000084	.....	.....
10,750	43,000	.001367	0.	.....	.....
11,000	44,000	.001433	.000066	Elastic limit.
11,250	45,000	.001567	.000134	.....	.....
11,500	46,000	.001667	.000100	.....	.....
11,750	47,000	.001767	.000100	.....	.....
12,000	48,000	.002167	.000400	.....	.....
12,250	49,000	.002733	.000566	Tensile strength.
21,680	86,720	.1300	.127267	.....	.....

General summary.

Tensile strength per square inch of original section.....	pounds..	86,720
Elastic limit per square inch of original section.....	do...	44,000
Elongation per inch after rupture.....	inch...	.2133
Elongation per inch under strain at elastic limit.....	do...	.001433
Reduction in diameter at point of rupture.....	do...	.164
Reduction in area after rupture, per cent of original section.....		49.7
Position of rupture.....		1/2 from neck
Character of broken surface.....		silky
Elongation of inch sections.....	"10, "22, "32"	

TUBE No. 18.

No. 5382.

Marks, ¹⁰R, T
M T, O

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	.....
2,500	10,000	.000300	.000200	.....	.....
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.000967	.000334	.....	.....
8,750	35,000	.001100	.000133	0.	.....
10,000	40,000	.001300	.000200	0.	.....
10,250	41,000	.001333	.000033	.....	.....
10,500	42,000	.001367	.000034	.....	.....
10,750	43,000	.001400	.000033	.....	.....
11,000	44,000	.001433	.000033	.....	.....
11,250	45,000	.001467	.000034	.....	.....
11,500	46,000	.001500	.000033	.....	.....
11,750	47,000	.001533	.000033	.....	.....
12,000	48,000	.001600	.000067	.....	.....
12,250	49,000	.001667	.000067	.....	.....
12,500	50,000	.003667	.002000	.....	.....
12,750	51,000	.005333	.001668	.....	.....
13,000	52,000	.006433	.001100	.....	.....
13,250	53,000	.007500	.001067	.....	.....
13,500	54,000	.009000	.001500	.....	.....
21,480	85,720	.1538	.1443	.....	.....
						Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,720
Elastic limit per square inch of original section	do.	49,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do.	.001667
Reduction in diameter at point of rupture	do.	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture	1" .14 from neck	
Character of broken surface	silky	
Elongation of inch sections	".37", ".20", ".13	

TUBE.

No. 5391.

Marks, 6306 B,
B T, O

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....
2,500	10,000	.000300	.000200	.....	.....
5,000	20,000	.000533	.000333	.....	.....
7,500	30,000	.000533	.000300	.....	.....
8,750	35,000	.001100	.000187	0.	.....
10,000	40,000	.001267	.000187	0.	.....
10,250	41,000	.001360	.000033	.....	.....
10,500	42,000	.001333	.000033	.....	.....
10,750	43,000	.001367	.000034	.....	.....
11,000	44,000	.001400	.000033	.....	.....
11,250	45,000	.001433	.000033	.....	.....
11,500	46,000	.001467	.000034	.....	.....
11,750	47,000	.001533	.000066	.....	.....
12,000	48,000	.002000	.000467	.....	.....
12,250	49,000	.002700	.000700	.....	.....
12,500	50,000	.003533	.000833	.....	.....
12,750	51,000	.004500	.000987	.....	.....
18,000	52,000	.005667	.001187	.....	.....
22,410	89,640	.130000	.124333	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	89,640
Elastic limit per square inch of original section.....	do..	47,000
Elongation per inch after rupture.....	inch..	.2267
Elongation per inch under strain at elastic limit.....	do..	.001533
Reduction in diameter at point of rupture.....	do..	.154
Reduction in area after rupture, per cent of original section.....		49.7
Position of rupture.....		1".35 from neck
Character of broken surface.....		silky
Elongation of inch sections.....		".13, ".32, ".22

TUBE.

No. 5390

Marks, ^{6306 B}_{M T, M}

Diameter, ¹¹/₁₆ 564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000287	.000200	.....	.....
5,000	20,000	.000600	.000333	.....	.....
7,500	30,000	.000933	.000333	.....	.....
8,750	35,000	.001100	.000167	0.	.....
10,000	40,000	.001300	.000200	0.	.....
10,250	41,000	.001333	.000033	.....	.....
10,500	42,000	.001367	.000034	.....	.....
10,750	43,000	.001400	.000035	.....	.....
11,000	44,000	.001433	.000033	.....	.....
11,250	45,000	.001433	0.	.....	.....
11,500	46,000	.001467	.000034	.....	.....
11,750	47,000	.001500	.000033	.....	.....
12,000	48,000	.001533	.000033	.....	.....
12,250	49,000	.001567	.000034	.....	.....
12,500	50,000	.001633	.000066	.....	.....
12,750	51,000	.001667	.000034	.....	.....
13,000	52,000	.001967	.000300	.....	.....
13,250	53,000	.002333	.000866	.....	.....
13,500	54,000	.004333	.001500	.....	.....
13,750	55,000	.005500	.001167	.....	.....
14,000	56,000	.006667	.001167	.....	.....
22,720	90,880	.1233	.116633	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	90,880
Elastic limit per square inch of original section	do	51,000
Elongation per inch after rupture	inch	.1833
Elongation per inch under strain at elastic limit	do	.001667
Reduction in diameter at point of rupture	do	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture	1", 27 from neck	
Character of broken surface	silky	
Elongation of inch sections	"12, "26", "17	

TUBE.

No. 5469.

Marks, ^{6326 B₁}
_{B T₂ M}
 Diameter, ¹¹/₁₆ .564.
 Sectional area, .25 square inch.
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000333	.000200	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001000	.000333	.....	.....
8,750	35,000	.001200	.000200	0.	.....
10,000	40,000	.001367	.000167	0.	.....
10,250	41,000	.001400	.000033	.....	.....
10,500	42,000	.001433	.000033	.....	.....
10,750	43,000	.001467	.000034	.....	.....
11,000	44,000	.001533	.000066	.....	.....
11,250	45,000	.001567	.000034	.....	.....
11,500	46,000	.001633	.000066	.....	.....
11,750	47,000	.001667	.000034	.....	.....
12,000	48,000	.001700	.000033	.....	.....
12,250	49,000	.006333	.004633	.....	.....
12,500	50,000	.007400	.001067	.....	.....
12,750	51,000	.008267	.000867	.....	.....
13,000	52,000	.009167	.000900	.....	.....
13,250	53,000	.010000	.000833	.....	.....
21,860	87,440	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,440
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section .....	.....	49.7
Position of rupture .....	.....	at middle of stem
Character of broken surface .....	.....	silky
Elongation of inch sections .....	.....	" .14, ".43, ".15

TUBE.

No. 5468.

Marks, ^{6326 B,} M T, M
 Diameter, ¹/₁₆ .564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1, 000	0.	0.	0.	0.	
1, 250	5, 000	.000100	.000100	0.	0.	
2, 500	10, 000	.000333	.000233	0.	0.	
5, 000	20, 000	.000667	.000334	0.	0.	
7, 500	30, 000	.001033	.000366	0.	0.	
8, 750	35, 000	.001200	.000167	0.	0.	
10, 000	40, 000	.001367	.000167	0.	0.	
10, 250	41, 000	.001400	.000033	0.	0.	
10, 500	42, 000	.001433	.000033	0.	0.	
10, 750	43, 000	.001500	.000067	0.	0.	
11, 000	44, 000	.001533	.000033	0.	0.	
11, 250	45, 000	.001567	.000034	0.	0.	
11, 500	46, 000	.001600	.000033	0.	0.	
11, 750	47, 000	.001633	.000033	0.	0.	
12, 000	48, 000	.001667	.000034	0.	0.	
12, 250	49, 000	.001700	.000033	0.	0.	
12, 500	50, 000	.001767	.000067	0.	0.	
12, 750	51, 000	.001867	.000100	0.	0.	
13, 000	52, 000	.005433	.003566	0.	0.	
13, 250	53, 000	.006167	.000734	0.	0.	
13, 500	54, 000	.007500	.001333	0.	0.	
13, 750	55, 000	.008500	.001000	0.	0.	
22, 320	89, 280					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89, 280
Elastic limit per square inch of original section	do...	50, 000
Elongation per inch after rupture	inch..	.2433
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture	at middle of stem	
Character of broken surface	silky	
Elongation of inch sections	"16, "42*, "15	

TUBE.

No. 5475.

Marks, ^{6816 B₁}_{B T₂ M}
 Diameter, ¹¹.565.
 Sectional area, .25 square inch.
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....
2,500	10,000	.000333	.000200	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001033	.000366	.....	.....
8,750	35,000	.001200	.000167	0.	.....
10,000	40,000	.001367	.000167	0.	.....
10,250	41,000	.001400	.000033	.....	.....
10,500	42,000	.001433	.000033	.....	.....
10,750	43,000	.001500	.000067	.....	.....
11,000	44,000	.001567	.000067	Elastic limit.
11,250	45,000	.001600	.000033	.....	.....
11,500	46,000	.002000	.000400	.....	.....
11,750	47,000	.005067	.003067	.....	.....
12,000	48,000	.005567	.000500	Tensile strength.
12,250	48,000	.006500	.000933	.....	.....
12,500	49,000	.007333	.000838	.....	.....
12,500	50,000	.008333	.001000	.....	.....
21,070	84,280	.1400	.131667	.....	.....

General summary.

Tensile strength per square inch of original section	pounds..	84,280
Elastic limit per square inch of original section.....	do...	45,000
Elongation per inch after rupture.....	inch..	.2367
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section.....		52.2
Position of rupture.....	1''.	7 from neck
Character of broken surface.....		silky
Elongation of inch sections.....	"	.18, ".42*, ".16

TUBE.

No. 5474.

Marks, ^{6816 B}_{M T, M}

Diameter, ".565.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000633	.000333			
7,500	30,000	.000967	.000334			
8,750	35,000	.001133	.000166	0.		
10,000	40,000	.001333	.000200	0.		
10,250	41,000	.001367	.000034			
10,500	42,000	.001400	.000033			
10,750	43,000	.001433	.000033			
11,000	44,000	.001467	.000034			
11,250	45,000	.001533	.000066			
11,500	46,000	.001567	.000034			
11,750	47,000	.001600	.000033			
12,000	48,000	.001633	.000033			
12,250	49,000	.001667	.000034			
12,500	50,000	.001700	.000033			
12,750	51,000	.001733	.000033			
13,000	52,000	.001767	.000034			
13,250	53,000	.001833	.000066			
13,500	54,000	.003267	.001434			
13,750	55,000	.006500	.003233			
14,000	56,000	.007333	.000833			
14,250	57,000	.008200	.000867			
14,500	58,000	.009167	.000967			
23,000	92,000	.1333	.124133			

General summary.

Tensile strength per square inch of original section	pounds..	92,000
Elastic limit per square inch of original section	do..	53,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do..	.001833
Reduction in diameter at point of rupture	do..	.115
Reduction in area after rupture, per cent of original section		38.4
Position of rupture		".70 from neck
Character of broken surface		silky, 60 per cent; granular, 40 per cent
Elongation of inch sections		".32", ".15", ".13"

TUBE.

No. 5479.

Marks, ^{6361 B₁}
B T, M

Diameter, ".565.

Sectional area, .25 square inch.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000233	.000200	.....	.....
5,000	20,000	.000700	.000867	.....	.....
7,500	30,000	.001033	.000333	.....	.....
8,750	35,000	.001200	.000167	.000033	.000033	
10,000	40,000	.001367	.000167	.000033	0.	
10,250	41,000	.061433	.000066	.....	.....
10,500	42,000	.001467	.000034	.....	.....
10,750	43,000	.001500	.000033	.....	.....
11,000	44,000	.001567	.000067	Elastic limit.
11,250	45,000	.001633	.000066	.....	.....
11,500	46,000	.001667	.000234	.....	.....
11,750	47,000	.004667	.002800	.....	.....
11,750	47,000	.005900	.001233	.....	.....
12,000	48,000	.006500	.000600	Tensile strength.
12,250	49,000	.007333	.000833	.....	.....
12,500	50,000	.008333	.001000	.....	.....
21,290	85,160	.1433	.134967	.....	.....

General summary.

Tensile strength per square inch of original section	pounds..	85,160
Elastic limit per square inch of original section	do ..	45,000
Elongation per inch after rupture	inch ..	.2333
Elongation per inch under strain at elastic limit	do ..	.001633
Reduction in diameter at point of rupture	do ..	.175
Reduction in area after rupture, per cent of original section		52.2
Position of rupture	1".65 from neck	
Character of broken surface	silky	
Elongation of inch sections	" .16, ".42", ".12	

TUBE.

No. 5478.

Marks, ^{6361 B,}
M T, M

Diameter, " .565.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	-----	
2,500	10,000	.000300	.000167	-----	-----	
5,000	20,000	.000667	.000267	-----	-----	
7,500	30,000	.001000	.000333	-----	-----	
8,750	35,000	.001200	.000200	0.	-----	
10,000	40,000	.001367	.000167	0.	-----	
10,250	41,000	.001433	.000066	-----	-----	
10,500	42,000	.001467	.000034	-----	-----	
10,750	43,000	.001500	.000033	-----	-----	
11,000	44,000	.001567	.000067	-----	-----	
11,250	45,000	.001600	.000033	-----	-----	
11,500	46,000	.001667	.000067	-----	-----	
11,750	47,000	.001700	.000033	-----	-----	
12,000	48,000	.001733	.000033	-----	-----	
12,250	49,000	.001800	.000067	-----	-----	
12,500	50,000	.001833	.000033	-----	-----	Elastic limit.
12,750	51,000	.002167	.000334	-----	-----	
13,000	52,000	.005667	.003500	-----	-----	
13,250	53,000	.007667	.002000	-----	-----	
13,500	54,000	.008667	.001000	-----	-----	
13,750	55,000	.008333	.000066	-----	-----	
22,610	90,440	.1400	.130667	-----	-----	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	90,440
Elastic limit per square inch of original section.....	do.....	50,000
Elongation per inch after rupture.....	inch..	.1900
Elongation per inch under strain at elastic limit.....	do.....	.001833
Reduction in diameter at point of rupture.....	do.....	.145
Reduction in area after rupture, per cent of original section.....	.....	44.6
Position of rupture.....	1" .29 from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	" .16, ".29, ".12	

TUBE.

No. 5530.

Marks, ^{6030 B₁}
_{M T₁₀ M.}
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000333	.000200			
5,000	20,000	.000700	.000367			
7,500	30,000	.001067	.000367			
8,750	35,000	.001200	.000133	0.		
10,000	40,000	.001400	.000200	.000033	.000033	
10,250	41,000	.001433	.000033			
10,500	42,000	.001467	.000034			
10,750	43,000	.001500	.000033			
11,000	44,000	.001567	.000067			Elastic limit.
11,250	45,000	.003167	.001600			
11,500	46,000	.004133	.000966			
11,750	47,000	.005000	.000867			
12,000	48,000	.006167	.001167			
12,250	49,000	.007333	.001166			Tensile strength.
22,410	89,640	.1500	.142667			

General summary.

Tensile strength per square inch of original section.....	pounds..	89,640
Elastic limit per square inch of original section.....	do...	44,000
Elongation per inch after rupture.....	inch...	.2133
Elongation per inch under strain at elastic limit.....	do...	.001567
Reduction in diameter at point of rupture.....	do...	.144
Reduction in area after rupture, per cent of original section.....		44.6
Position of rupture.....	1" from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	".36", ".18", ".10	

TUBE.

No. 5534.

Marks, ^{7407 B,}
B T, M

Diameter, ¹¹/₁₆ 564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000333	.000200	0.	0.	
5,000	20,000	.000667	.000334	0.	0.	
7,500	30,000	.001000	.000333	0.	0.	
8,750	35,000	.001200	.000200	0.	0.	
10,000	40,000	.001400	.000200	0.	0.	
10,500	42,000	.001467	.000067	0.	0.	
10,750	43,000	.001500	.000033	0.	0.	
11,000	44,000	.001533	.000033	0.	0.	
11,250	45,000	.001567	.000034	0.	0.	Elastic limit.
11,500	46,000	.001633	.000066	0.	0.	
11,750	47,000	.004500	.002867	0.	0.	
12,000	48,000	.005667	.001167	0.	0.	
12,250	49,000	.006600	.000933	0.	0.	
12,500	50,000	.008667	.002067	0.	0.	Tensile strength.
12,750	51,000	.009833	.001166	0.	0.	
21,500	86,000					

General summary.

Tensile strength per square inch of original section	..... pounds ..	86,000
Elastic limit per square inch of original section	..... do ..	46,000
Elongation per inch after rupture	..... inch ..	.2333
Elongation per inch under strain at elastic limit	..... do ..	.001633
Reduction in diameter at point of rupture	..... do ..	.184
Reduction in area after rupture, per cent of original section	.....	54.6
Position of rupture	.....	1'' 4 from neck
Character of broken surface	.....	silky
Elongation of inch sections	.....	" 13, " 39, " 18

TUBE.

No. 5533.

Marks, ^{7407 B}MT₂M
 Diameter, "564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
150	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000333	.000200			
5,000	20,000	.000700	.000367			
7,500	30,000	.001033	.000333			
8,750	35,000	.001200	.000167	0.		
10,000	40,000	.001367	.000167			
10,500	42,000	.001433	.000066	0.		
10,750	43,000	.001500	.000067			
11,000	44,000	.001567	.000067			
11,250	45,000	.001600	.000033			
11,500	46,000	.001633	.000033			
11,750	47,000	.001667	.000034			
12,000	48,000	.001700	.000033			Elastic limit.
12,250	49,000	.001733	.000033			
12,500	50,000	.001833	.000209			
12,750	51,000	.002567	.000634			
13,000	52,000	.003733	.001166			
13,250	53,000	.005333	.001600			
13,500	54,000	.007000	.001667			Tensile strength.
22,230	88,920					

General summary.

Tensile strength per square inch of original section	pounds..	88,920
Elastic limit per square inch of original section	do ..	49,000
Elongation per inch after rupture	inch ..	.2367
Elongation per inch under strain at elastic limit	do ..	.001733
Reduction in diameter at point of rupture	do ..	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture	at middle of stem	
Character of broken surface	silky	
Elongation of inch sections	" .15, " .43, " .18	

JACKET No. 20.

No. 5386.

Marks, ^{10 R 30 J}_{B T 10}
 Diameter, ".564.
 Sectional area, .25.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000300	.000233	.....	.....
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.000967	.000334	.....	.....
8,750	35,000	.001167	.000200	0.	0.	Elastic limit.
10,000	40,000	.001367	.000200	.....	.....
10,250	41,000	.001400	.000033	.....	.....
10,500	42,000	.002967	.001567	.001400	.001400	
10,750	43,000	.003567	.000600	.....	.....
11,000	44,000	.004667	.001100	Tensile strength.
11,250	45,000	.005767	.001100	.....	.....
11,500	46,000	.007000	.001233	.....	.....
11,750	47,000	.007833	.000833	.....	.....
20,000	80,240	.1667	.158867	.....	.....

General summary.

Tensile strength per square inch of original section pounds.. 80,240
 Elastic limit per square inch of original section do... 41,000
 Elongation per inch after rupture inch... .2700
 Elongation per inch under strain at elastic limit do... .001400
 Reduction in diameter at point of rupture do... .204
 Reduction in area after rupture, per cent of original section 59.3
 Position of rupture 1".35 from neck
 Character of broken surface silky
 Elongation of inch sections ".15, ".40", ".56

JACKET No. 20.

No. 5387.

Marks, ^{10 R 20 J}_{M T, O}
 Diameter, ¹¹.564.
 Sectional area, .25 square inch.
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000133	.000133	0.	0.		
2,500	10,000	.000333	.000200	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001000	.000333	.....	.....
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001333	.000133	.....	.....
10,500	42,000	.001367	.000034	0.	.....	
10,750	43,000	.001400	.000033	.....	.....
11,000	44,000	.001433	.000033	.....	.....
11,250	45,000	.001467	.000034	.....	.....
11,500	46,000	.001500	.000033	.....	.....
11,750	47,000	.001533	.000033	.....	.....
12,000	48,000	.001600	.000067	.....	.....
12,250	49,000	.001633	.000033	.....	.....
12,500	50,000	.001667	.000034	.....	.....
12,750	51,000	.001733	.000066	.....	.....
13,000	52,000	.003267	.001534		Elastic limit.
13,250	53,000	.005000	.001733	.....	.....
13,500	54,000	.006000	.001000	.....	.....
13,750	55,000	.007200	.001200	.....	.....
14,000	56,000	.008167	.000967	.....	.....
22,120	88,480	.009500	.001333	.....	.....
		.1400	.1305	Tensile strength.	

General summary.

Tensile strength per square inch of original section	pounds..	38,480
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch...	.2033
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section	do...	44.6
Position of rupture	1'' .4 from neck	
Character of broken surface	silky	
Elongation of inch sections	" .11, ".84, ".16	

JACKET.

No. 5393.

Marks, ^{6427 B.}
B T, M

Diameter, ¹¹/₁₆ .564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000300	.000200	.....	.....
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.000967	.000334	.....	.....
8,750	35,000	.001100	.000133	0.	.....
10,000	40,000	.001207	.000167	.....	.....
10,500	42,000	.001333	.000066	0.	.....
10,750	43,000	.001367	.000034	.....	.....
11,000	44,000	.001400	.000033	.....	.....
11,250	45,000	.001433	.000033	.....	.....
11,500	46,000	.001467	.000034	.....	.....
11,750	47,000	.001500	.000033	.....	.....
12,000	48,000	.001567	.000067	.....	.....
12,250	49,000	.001600	.000033	.....	.....
12,500	50,000	.001633	.000033	.....	.....
12,750	51,000	.001667	.000034	.....	.....
13,000	52,000	.001700	.000033	.....	.....
13,250	53,000	.001733	.000033	.....	.....
13,500	54,000	.002100	.000367	.....	.....
13,750	55,000	.002067	.000867	.....	.....
14,000	56,000	.003733	.000766	.....	.....
14,250	57,000	.004833	.001100	.....	.....
14,500	58,000	.005667	.000834	.....	.....
24,500	98,360	.1300	.124333	.....	.....
						Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,360
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1'' .66 from neck
Character of broken surface		silky, in part contains trace of granulation
Elongation of inch sections		" .14, ".33, ".15

JACKET.

No. 5392.

Marks, ^{6427 B₁}
_{M T² M}
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,600	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000633	.000333			
7,500	30,000	.000967	.000334			
8,750	35,000	.001133	.000166	0.		
10,000	40,000	.001300	.000167			
10,500	42,000	.001367	.000067	0.		
10,750	43,000	.001400	.000033			
11,000	44,000	.001433	.000033			
11,250	45,000	.001467	.000034			
11,500	46,000	.001533	.000066			
11,750	47,000	.001567	.000034			
12,000	48,000	.001633	.000066			
12,250	49,000	.001667	.000034			
12,500	50,000	.001700	.000033			
12,750	51,000	.001733	.000033			
13,000	52,000	.001767	.000034			
13,250	53,000	.001800	.000033			Elastic limit.
13,500	54,000	.002100	.000300			
13,750	55,000	.003000	.000900			
14,000	56,000	.004167	.001167			
14,250	57,000	.005167	.001000			
14,500	58,000	.006167	.001000			
24,480	97,920					Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	97,020
Elastic limit per square inch of original section.....	do..	53,000
Elongation per inch after rupture.....	inch..	.1000
Elongation per inch under strain at elastic limit.....	do..	.001800
Reduction in diameter at point of rupture.....	do..	.034
Reduction in area after rupture, per cent of original section.....		11.6
Position of rupture.....		".25 from neck
Character of broken surface.....		granular, radiating from a flaky spot at the circumference
Elongation of inch sections.....		".12", ".11", ".07

JACKET.

No. 5407.

Marks, ^{6771 B₁}
 B T₁ M₁
 Diameter, ¹/₂ 564.
 Sectional area, .25 square inch.
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000333	.000200			
5,000	20,000	.000700	.000367			
7,500	30,000	.001033	.000333			
8,750	35,000	.001233	.000200	.000033	.000033	
10,000	40,000	.001400	.000107			
10,500	42,000	.001467	.000087	.000033	0.	
10,750	43,000	.001500	.000033			
11,000	44,000	.001533	.000033			
11,250	45,000	.001567	.000034			
11,500	46,000	.001600	.000033			
11,750	47,000	.001633	.000033			
12,000	48,000	.001667	.000034			
12,250	49,000	.001700	.000033			
12,500	50,000	.001733	.000033			
12,750	51,000	.001767	.000034			
13,000	52,000	.001833	.000066			Elastic limit.
13,250	53,000	.002133	.000300			
13,500	54,000	.003333	.001200			
13,750	55,000	.005000	.001667			
14,000	56,000	.005833	.000833			
14,250	57,000	.006833	.001000			
24,640	98,560	.1400	.133167			Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	98,560
Elastic limit per square inch of original section.....	do...	52,000
Elongation per inch after rupture.....	Inch..	.1933
Elongation per inch under strain at elastic limit.....	do...	.001833
Reduction in diameter at point of rupture.....	do...	.134
Reduction in area after rupture, per cent of original section.....		41.9
Position of rupture.....	1" .16 from neck	
Character of broken surface.....	dull, silky	
Elongation of inch section.....	"12, "19, "27"	

JACKET.

No. 5406.

Marks, ^{8771B} M T, M

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000333	.000333	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001000	.000333	.....	.....
8,750	35,000	.001167	.000167	0.	.....
10,000	40,000	.001333	.000166	.....	.....
10,500	42,000	.001400	.000087	0.	.....
10,750	43,000	.001433	.000033	.....	.....
11,000	44,000	.001467	.000034	.....	.....
11,250	45,000	.001500	.000033	.....	.....
11,500	46,000	.001533	.000033	.....	.....
11,750	47,000	.001567	.000034	.....	.....
12,000	48,000	.001633	.000066	.....	.....
12,250	49,000	.001667	.000034	.....	.....
12,500	50,000	.001700	.000033	.....	.....
12,750	51,000	.001733	.000033	.....	.....
13,000	52,000	.001767	.000034	.....	.....
13,250	53,000	.001833	.000066	.....	.....
13,500	54,000	.002000	.000167	.....	.....
13,750	55,000	.002333	.000333	.....	.....
14,000	56,000	.004000	.001167	.....	.....
14,250	57,000	.005000	.001000	.....	.....
14,500	58,000	.008000	.001000	.....	.....
24,510	98,040	.1300	.1240	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	98,040
Elastic limit per square inch of original section.....	do.	53,000
Elongation per inch after rupture.....	inch.	.1300
Elongation per inch under strain at elastic limit.....	do.	.001833
Reduction in diameter at point of rupture.....	do.	.154
Reduction in area after rupture, per cent of original section.....		47.2
Position of rupture.....	at middle of stem.	
Character of broken surface.....	silky	
Elongation of inch sections.....	" .13, ". 53, ". 13	

JACKET.

No. 5477.

Marks, ^{6889 B,}
 B T, M
 Diameter, ".565.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....
2,500	10,000	.000300	.000167	.....	.....
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.001000	.000367	.....	.....
8,750	35,000	.001167	.000167	0.	.....
10,000	40,000	.001400	.000233	.....	.....
10,500	42,000	.001533	.000133	.000067	.000067	Elastic limit.
10,750	43,000	.001667	.000134	.....	.....
11,000	44,000	.002333	.001166	.....	.....
11,250	45,000	.003733	.000900	.....	.....
11,500	46,000	.004867	.001134	.....	.....
11,750	47,000	.005700	.000633	.....	.....
21,190	84,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,760
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.175
Reduction in area after rupture, per cent of original section	do...	52.2
Position of rupture	"	.6 from neck
Character of broken surface		silky
Elongation of inch sections	"	.40, ".15, ".11

JACKET.

No. 5476.

Marks, ⁶⁸³⁰ B.
M T, M.
Diameter, " .565.
Sectional area, .25 square inch.
Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....
2,500	10,000	.000333	.000200	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001000	.000333	.....	.....
8,750	35,000	.001200	.000200	0.	.....
10,000	40,000	.001367	.000167	.....	.....
10,500	42,000	.001467	.000100	0.	.....
10,750	43,000	.001500	.000033	.....	.....
11,000	44,000	.001533	.000033	.....	.....
11,250	45,000	.001567	.000034	.....	.....
11,500	46,000	.001600	.000033	.....	.....
11,750	47,000	.001633	.000033	.....	.....
12,000	48,000	.001667	.000034	.....	.....
12,250	49,000	.001733	.000066	.....	.....
12,500	50,000	.001800	.000067	.....	.....
12,750	51,000	.001833	.000033	.....	.....
13,000	52,000	.001867	.000034	.....	.....
13,250	53,000	.002200	.000333	.....	.....
13,500	54,000	.004967	.002667	.....	.....
13,750	55,000	.006767	.000900	.....	.....
14,000	56,000	.008933	.001166	.....	.....
14,250	57,000	.007900	.000867	.....	.....
23,270	93,080	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	93,080
Elastic limit per square inch of original section.....	do..	53,000
Elongation per inch after rupture.....	inch..	.1987
Elongation per inch under strain at elastic limit.....	do..	.001867
Reduction in diameter at point of rupture.....	do..	.165
Reduction in area after rupture, per cent of original section.....		49.7
Position of rupture.....	at middle of stem	
Character of broken surface.....	silky	
Elongation of inch sections.....	" .13, ".35, ".11	

JACKET.

No. 5525.

Marks, 7178 B₁
B T, M.

Diameter, .564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000123	.000123	0.	0.	
2,500	10,000	.000323	.000200	.....	.....
5,000	20,000	.000700	.000367	.....	.....
7,500	30,000	.001067	.000367	.....	.....
8,750	35,000	.001232	.000166	.000033	.000033	
10,000	40,000	.001432	.000200	.....	.....
10,500	42,000	.001500	.000067	.000033	0.	
10,750	43,000	.001532	.000033	.....	.....
11,000	44,000	.001567	.000034	.....	.....
11,250	45,000	.001600	.000033	.....	.....
11,500	46,000	.001623	.000033	.....	.....
11,750	47,000	.001667	.000034	.....	.....
12,000	48,000	.001700	.000033	.....	.....
12,250	49,000	.001767	.000067	.....	.....
12,500	50,000	.001832	.000066	.....	.....
12,750	51,000	.002000	.000167	.....	.....
13,000	52,000	.002432	.000433	.....	.....
13,250	53,000	.004323	.002400	.....	.....
13,500	53,000	.005600	.000767	.....	.....
13,500	54,000	.006667	.001067	.....	.....
23,480	93,920	.1400	.133333	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	93,920
Elastic limit per square inch of original section.....	do..	49,000
Elongation per inch after rupture.....	inch..	.2267
Elongation per inch under strain at elastic limit.....	do..	.001767
Reduction in diameter at point of rupture.....	do..	.144
Reduction in area after rupture, per cent of original section.....	do..	44.6
Position of rupture.....	1".58 from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	" .15, ".36, ".17	

JACKET.

No. 5524.

Marks, 7178 B,
 M T, M.
 Diameter, $\frac{1}{2}$ " .564.
 Sectional area, .25 square inch.
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....
2,500	10,000	.000200	.000267	.....	.....
5,000	20,000	.000500	.000300	.....	.....
7,500	30,000	.000667	.000367	.....	.....
8,750	35,000	.001067	.000300	.000033	.000033	
10,000	40,000	.001233	.001166	.....	.....
10,500	42,000	.001267	.000334	.000033	0.	
10,750	43,000	.001333	.000066	.....	.....
11,000	44,000	.001400	.000667	.....	.....
11,250	45,000	.001433	.000033	.....	.....
11,500	46,000	.001467	.000034	.....	.....
11,750	47,000	.001500	.000033	.....	.....
12,000	48,000	.001533	.000033	.....	.....
12,250	49,000	.001567	.000034	.....	.....
12,500	50,000	.001800	.000233	Elastic limit.
12,750	51,000	.002533	.000733	.....	.....
13,000	52,000	.003133	.000600	.....	.....
13,250	53,000	.003733	.003600	.....	.....
13,500	54,000	.007367	.000634	.....	.....
13,750	55,000	.008333	.000966	Tensile strength.
22,940	91,760	.1433	.13467	.....	.....

General summary.

Tensile strength per square inch of original section.....	pounds..	91,760
Elastic limit per square inch of original section.....	do..	49,000
Elongation per inch after rupture.....	inch..	.2133
Elongation per inch under strain at elastic limit.....	do..	.001567
Reduction in diameter at point of rupture.....	do..	.154
Reduction in area after rupture, per cent of original section.....	.....	47.2
Position of rupture.....	1" .5 from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	" .15, " .30, " .19	

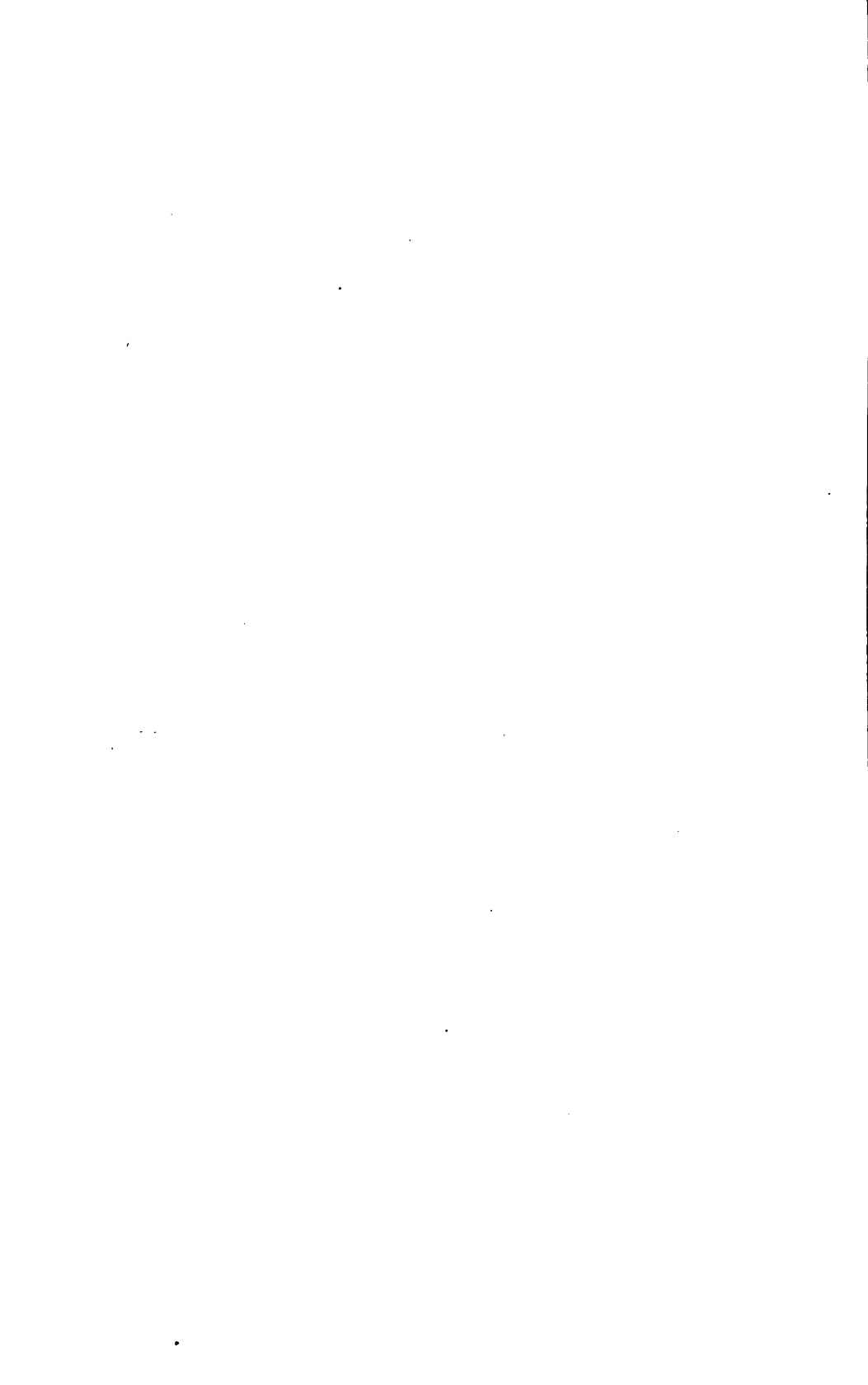
TABULATION OF TENSION SPECIMENS FROM 10-INCH STEEL B. L. RIFLES
(STEMS 3' LONG, ".564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
5379	Tube No. 17...	Outside.	<i>Pounds.</i> 45,000	<i>Pounds.</i> 79,500	<i>Pr. ct.</i> 4.3	<i>Pr. ct.</i> 4.8	Granular, radiating from a dull spot at the circumference.	Breech end.
5380	.....do.....	.....do.....	48,000	84,700	21.6	49.7	Silky	Muzzle end.
5381	Tube No. 18...	.....do.....	44,000	86,730	21.3	49.7	.....do.....	Breech end.
5382	.....do.....	.....do.....	49,000	85,720	23.3	49.7	.....do.....	Muzzle end.
5391	Tube.....do.....	.....do.....	47,000	89,640	22.7	49.7	.....do.....	Breech end.
5390	.....do.....	Middle.....	51,000	90,880	18.3	47.2	.....do.....	Muzzle end.
5469	.....do.....	.....do.....	48,000	87,440	24.0	49.7	.....do.....	Breech end.
5468	.....do.....	.....do.....	50,000	89,280	24.3	52.2	.....do.....	Muzzle end.
5475	.....do.....	.....do.....	45,000	84,280	23.7	52.2	.....do.....	Breech end.
5474	.....do.....	.....do.....	53,000	92,000	19.7	36.4	Silky, 60 per cent; granular, 40 per cent.	Muzzle end.
5479	.....do.....	.....do.....	45,000	85,160	23.3	52.2	Silky	Breech end.
5478	.....do.....	.....do.....	50,000	90,440	19.0	44.6	.....do.....	Muzzle end.
5530	.....do.....	.....do.....	44,000	89,640	21.3	44.6	.....do.....	Do.
5534	.....do.....	.....do.....	48,000	86,000	23.3	54.6	.....do.....	Breech end.
5533	.....do.....	.....do.....	49,000	88,920	23.7	54.6	.....do.....	Muzzle end.
5388	Jacket No. 20...	Outside	41,000	80,240	27.0	59.3	.....do.....	Breech end.
5387	.....do.....	.....do.....	51,000	88,480	20.3	44.6	.....do.....	Muzzle end.
5393	Jacket.....do.....	Middle.....	53,000	96,360	20.7	36.4	Silky, in part granular.	Breech end.
5392	.....do.....	.....do.....	53,000	97,920	10.0	11.6	Granular, radiating from spot in circumference.	Muzzle end.
5407	.....do.....	.....do.....	52,000	96,580	19.3	41.9	Dull silky	Breech end.
5406	.....do.....	.....do.....	53,000	98,040	19.0	47.2	Silky	Muzzle end.
5477	.....do.....	.....do.....	42,000	84,700	22.0	52.2	.....do.....	Breech end.
5476	.....do.....	.....do.....	52,000	93,080	19.7	49.7	.....do.....	Muzzle end.
5525do.....do.....	49,000	96,920	22.7	44.6do.....	Breech end.
5524do.....do.....	49,000	91,760	21.3	47.2do.....	Muzzle end.

12-INCH STEEL B. L. RIFLES.

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SPECIMENS FROM TUBES AND JACKETS.



TUBE.

No. 5397.

Marks, 5964 B,
B T, M.

Diameter, 1.564.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied load.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000087	.000087	0.	0.	
2,500	10,000	.000200	.000233	.....	.....
5,000	20,000	.000333	.000333	.....	.....
7,500	30,000	.000467	.000334	.....	.....
8,750	35,000	.001167	.000200	.....	.....
10,000	40,000	.001267	.000200	.000033	.000033	
10,250	41,000	.001400	.000033	.....	.....
10,500	42,000	.001433	.000033	.....	.....
10,750	43,000	.001467	.000034	.....	.....
11,000	44,000	.001533	.000065	.....	.....
11,250	45,000	.001800	.000067	Elastic limit.
11,500	46,000	.001933	.000033	.....	.....
11,750	47,000	.001767	.000134	.....	.....
12,000	48,000	.002033	.000265	.....	.....
12,250	49,000	.002333	.000300	.....	.....
12,500	50,000	.002633	.000300	.....	.....
12,750	51,000	.002367	.000324	Tensile strength.
24,000	96,330	.1333	.130033	.....	.....

General summary.

Tensile strength per square inch of original section	pounds..	96,330
Elastic limit per square inch of original section	do..	45,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do..	.001633
Reduction in diameter at point of rupture	do..	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		at middle of stem
Character of broken surface		silky, interspersed with granular metal at the circumference
Elongation of inch sections		" .13, " .21, " .13

TUBE.

No. 5396.

Marks, 5004 B,
M T, MDiameter, $\frac{1}{4}$ 564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000087	.000067	0.	.....
2,500	10,000	.000900	.000223	.....	.....
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.000667	.000334	.....	.....
8,750	35,000	.001100	.000133	0.	.....
10,000	40,000	.001800	.000200	0.	.....
10,250	41,000	.001333	.000333	.....	.....
10,500	42,000	.001267	.000034	.....	.....
10,750	43,000	.001267	0.	.....	.....
11,000	44,000	.001400	.000083	.....	.....
11,250	45,000	.001433	.000333	.....	.....
11,500	46,000	.001467	.000334	.....	.....
11,750	47,000	.001533	.000066	.....	.....
12,000	48,000	.001600	.000067	.....	.....
12,250	49,000	.001633	.000333	.....	.....
12,500	49,000	.001667	.000034	.....	.....
12,750	51,000	.001700	.000333	.....	.....
13,000	52,000	.002000	.000300	.....	.....
13,250	53,000	.002267	.000367	.....	.....
13,500	54,000	.003067	.000700	.....	.....
13,750	55,000	.003700	.000633	.....	.....
14,000	56,000	.004667	.000667	.....	.....
24,180	96,730	.1200	.115333	.....	.....
						Elastic limit.
						Tensile strength.

General summary.

Tensile strength per square inch of original section pounds.. 96,730
 Elastic limit per square inch of original section do... 51,600
 Elongation per inch after rupture inch... .1433
 Elongation per inch under strain at elastic limit do... .001700
 Reduction in diameter at point of rupture do... .084
 Reduction in area after rupture, per cent of original section 21.4
 Position of rupture ".85 from neck
 Character of broken surface..... granular, radiating from a dull, flaky spot at the circumference.
 Opened a crack in the stem near the place of rupture.
 Elongation of inch sections ".18", ".14", ".11

TUBE.

No. 5509.

Marks, ^{8030 B.}_{B T, M}
 Diameter, '564.
 Sectional area, .25 square inch.
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000267	.000264	0.	0.	
5,000	20,000	.000733	.000266	0.	0.	
7,500	30,000	.001100	.000267	0.	0.	
8,750	35,000	.001267	.000187	.000033	.000033	
10,000	40,000	.001467	.000200	.000033	0.	
10,250	41,000	.001533	.000066	0.	0.	
10,500	42,000	.001567	.000034	0.	0.	
10,750	43,000	.001600	.000033	0.	0.	
11,000	44,000	.001667	.000067	0.	0.	Elastic limit.
11,250	45,000	.001700	.000033	0.	0.	
11,500	46,000	.001867	.000167	0.	0.	
11,750	47,000	.002067	.000200	0.	0.	
12,000	48,000	.002333	.000266	0.	0.	
12,250	49,000	.003000	.000267	0.	0.	
12,500	50,000	.003667	.000267	0.	0.	
12,750	51,000	.004333	.000466	0.	0.	
13,000	52,000	.005333	.001000	0.	0.	Tensile strength.
23,120	92,480	.1400	.134667	0.	0.	

General summary.

Tensile strength per square inch of original section.....	pounds..	92,480
Elastic limit per square inch of original section.....	do...	45,000
Elongation per inch after rupture.....	inch...	.1867
Elongation per inch under strain at elastic limit.....	do...	.001700
Reduction in diameter at point of rupture.....	do...	.104
Reduction in area after rupture, per centum of original section.....		23.5
Position of rupture.....		.95 from neck
Character of broken surface.....		granular, 50 per cent; silky, 50 per cent; irregular surface
Elongation of inch sections.....		".13, ".14, ".20"

TUBE.

No. 5508.

Marks, M T, M^{6030 B, -}Diameter, $\frac{1}{2}$.564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1, 000	0.	0.	0.	0.	
1, 250	5, 000	.000183	.000183	Elastic limit below 25,000 pounds per square inch.
2, 500	10, 000	.000863	.000200	.....	.....
5, 000	20, 000	.000700	.000867	.....	.....
7, 500	20, 000	.001083	.000833	.....	.....
8, 750	35, 000	.001833	.000800	.....	.....
9, 000	36, 000	.001433	.000100	Tensile strength.
9, 250	37, 000	.001500	.000067	.....	.....
9, 500	38, 000	.001567	.000067	.....	.....
9, 750	39, 000	.001633	.000066	.....	.....
10, 000	40, 000	.001733	.000100	.....	.....
10, 250	41, 000	.001900	.000167	.....	.....
10, 500	42, 000	.002083	.000183	.....	.....
10, 750	43, 000	.002200	.000167	.....	.....
11, 000	44, 000	.002367	.000167	.....	.....
11, 250	45, 000	.002900	.000533	.....	.....
11, 500	46, 000	.004067	.001767	.....	.....
11, 750	47, 000	.005233	.000566	.....	.....
12, 000	48, 000	.006000	.000767	.....	.....
12, 250	49, 000	.006667	.000667	.....	.....
12, 500	50, 000	.007533	.000866	.....	.....
22, 380	39, 520	.1600	.152467	.....	.....

General summary.

Tensile strength per square inch of original section pounds .. 39, 520
 Elastic limit per square inch of original section below 25,000 pounds per square inch
 Elongation per inch after rupture inch .. .2367
 Reduction in diameter at point of rupture do .. .144
 Reduction in area after rupture, per cent of original section 44.6
 Position of rupture at middle of stem
 Character of broken surface silky
 Elongation of inch sections ".17, ".36", ".18

JACKET.

No. 5395.

Marks, ^{6386 B,}
B T, M

Diameter, ¹/₁₆ .564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000333	.000266	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001000	.000333	.....	.....
8,750	35,000	.001200	.000200	0.	.....
10,000	40,000	.001367	.000167	.....	.....
10,500	42,000	.001400	.000033	0.	.....
10,750	43,000	.001433	.000033	.....	.....
11,000	44,000	.001500	.000067	.....	.....
11,250	45,000	.001533	.000033	.....	.....
11,500	46,000	.001600	.000067	.....	.....
11,750	47,000	.001633	.000033	.....	.....
12,000	48,000	.001700	.000067	Elastic limit.
12,250	49,000	.004177	.002467	.....	.....
12,500	50,000	.005000	.000833	.....	.....
12,750	51,000	.005433	.000433	.....	.....
13,000	52,000	.006067	.000634	.....	.....
13,250	53,000	.006667	.000600	.....	.....
24,090	98,360	.1400	.133333	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	98,360
Elastic limit per square inch of original section.....	do..	48,000
Elongation per inch after rupture.....	inch..	.2000
Elongation per inch under strain at elastic limit.....	do..	.001700
Reduction in diameter at point of rupture.....	do..	.114
Reduction in area after rupture, per cent of original section.....		36.4
Position of rupture.....		1'' .56 from neck
Character of broken surface.....	silky, in part interspersed with granular metal	
Elongation of inch sections.....		".14, ".31, ".15

JACKET.

No. 5394.

Marks, 6396 B,
M T, M

Diameter, 7.564.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....
2,500	10,000	.000333	.000233	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001000	.000333	.....	.....
8,750	35,000	.001200	.000200	0.	.....
10,000	40,000	.001367	.000167	.....	.....
10,500	42,000	.001400	.000323	0.	.....
10,750	43,000	.001433	.000023	.....	.....
11,000	44,000	.001500	.000067	.....	.....
11,250	45,000	.001533	.000033	.....	.....
11,500	46,000	.001600	.000067	.....	.....
11,750	47,000	.001633	.000033	.....	.....	Elastic limit.
12,000	48,000	.002133	.000500	.....	.....
12,250	49,000	.002667	.000534	.....	.....
12,500	50,000	.004667	.002090	.....	.....
12,750	51,000	.005333	.000666	.....	.....
13,000	52,000	.005933	.000600	.....	.....
23,960	95,840	.1333	.127367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,840
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch.	.2033
Elongation per inch under strain at elastic limit	do.	.001633
Reduction in diameter at point of rupture	do.	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture	at middle of stem	
Character of broken surface	silky	
Elongation of inch sections	" 13, " 33, " 15	

JACKET No. 10.

No. 5506.

Marks, ^{12 R₁₀ J}
_{B T₁ O}

Diameter, ¹¹/₁₆ 564.

Sectional area, .25 square inch.

Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000333	.000233	.....	.....
5,000	20,000	.000700	.000567	.....	.....
7,500	30,000	.001033	.000833	.....	.....
8,750	35,000	.001260	.000167	0.	.....
10,000	40,000	.001400	.000200	.....	.....
10,500	42,000	.001433	.000033	0.	.....
10,750	43,000	.001500	.000067	.....	.....
11,000	44,000	.001533	.000033	.....	.....
11,250	45,000	.001567	.000034	.....	.....
11,500	45,000	.001600	.000033	.....	.....
11,750	47,000	.001633	.000033	.....	.....
12,000	48,000	.001667	.000034	.....	.....
12,250	49,000	.001700	.000033	.....	.....
12,500	50,000	.001733	.000033	.....	.....
12,750	51,000	.001800	.000067	.....	.....
13,000	52,000	.001867	.000067	.....	.....
13,250	53,000	.001933	.000066	.....	.....
13,500	54,000	.002000	.000400	.....	.....
13,750	55,000	.002067	.001034	.....	.....
14,000	56,000	.004333	.001466	.....	.....
14,250	57,000	.006167	.001334	.....	.....
14,500	58,000	.006900	.000633	.....	.....
23,840	95,360	.1333	.1265	.....	.....

General summary.

Tensile strength per square inch of original section.....	pounds..	95,360
Elastic limit per square inch of original section.....	do...	53,000
Elongation per inch after rupture.....	inch..	1.967
Elongation per inch under strain at elastic limit.....	do...	.001933
Reduction in diameter at point of rupture.....	do...	.124
Reduction in area after rupture, per cent of original section.....	.....	39.2
Position of rupture.....	.....	1'' .28 from neck
Character of broken surface.....	granular, 50 per cent; silky, 50 per cent	
Elongation of inch sections.....	.....	'' .28, '' .25, '' .11

JACKET No. 10.

No. 5507.

Marks, ^{12 R 10 J.}
M T, O.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000123	.000133	0.	0.	
2,500	10,000	.000233	.000200	.....	.....
5,000	20,000	.000700	.000367	.....	.....
7,500	30,000	.001033	.000333	.....	.....
8,750	35,000	.001233	.000200	.000033	.000033	
10,000	40,000	.001400	.000167	.....	.....
10,500	42,000	.001467	.000067	.000033	0.	
10,750	43,000	.001500	.000033	.....	.....
11,000	44,000	.001533	.000033	.....	.....
11,250	45,000	.001567	.000034	.....	.....
11,500	46,000	.001600	.000033	.....	.....
11,750	47,000	.001633	.000033	.....	.....
12,000	48,000	.001667	.000034	.....	.....
12,250	49,000	.001700	.000033	.....	.....
12,500	50,000	.001733	.000033	.....	.....
12,750	51,000	.001767	.000034	.....	.....
13,000	52,000	.001833	.000036	.....	.....
13,250	53,000	.001900	.000037	.....	.....
13,500	54,000	.002000	.000100	.....	.....
13,750	55,000	.002233	.000233	.....	.....
14,000	56,000	.002433	.000200	.....	.....
14,250	57,000	.004000	.001567	.....	.....
14,500	58,000	.006000	.002000	.....	.....
23,890	95,520	.1333	.1273	.....	.....

General summary.

Tensile strength per square inch of original section.....	pounds..	35,520
Elastic limit per square inch of original section.....	do..	53,600
Elongation per inch after rupture.....	inch..	.2367
Elongation per inch under strain at elastic limit.....	do..	.001900
Reduction in diameter at point of rupture.....	do..	.164
Reduction in area after rupture, per cent of original section.....		49.7
Position of rupture.....	"	1". 57 from neck
Character of broken surface.....		silky
Elongation of inch sections.....		".15, ".36, ".18

TABULATION OF TENSION SPECIMENS FROM 12-INCH STEEL B. L. RIFLES
(STEMS 3' LONG, ".564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elon- gation.	Con- traction of area.	Appearance of fracture.	Remarks.
5397	Tube	Middle .	Pounds. 46,000	Pounds. 96,320	Pr. ct. 19	Pr. ct. 33.5	Silky, interspersed with granular metal at circumference.	Breech end.
5396	do	do	51,000	96,720	14.3	21.4	Granular, radiating from dull flaky spot at circumference.	Muzzle end.
5509	do	do	45,000	92,480	18.7	33.5	Granular 50 per cent, silky 50 per cent.	Breech end.
5508	do	do	(Below 35,000	89,520	23.7	44.6	Silky	Muzzle end.
5395	Jacket	do	48,000						96,360	20	36.4	Silky, interspersed with granular metal.	Breech end.
5394	do	do	47,000	95,840	20.3	44.6	Silky	Muzzle end.
5506	Jacket No. 10.	Outside.	53,000	95,360	19.7	39.2	Granular 50 per cent, silky 50 per cent.	Breech end.
5507	do	do	53,000	95,520	23.7	49.7	Silky	Muzzle end.



RIFLE-BARREL STEEL, .30 CALIBER.



BESSEMER STEEL.

No. 5385.

Marks, 44.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000633	.000833			
7,500	30,000	.000967	.000334			
10,000	40,000	.001333	.000366	0.		
12,500	50,000	.001633	.000300			
13,500	54,000	.001767	.000134			
13,750	55,000	.001800	.000038			
14,000	56,000	.001867	.000067			
14,250	57,000	.001900	.000033			
14,500	58,000	.001933	.000033			
14,750	59,000	.001967	.000034			
15,000	60,000	.002000	.000033			
15,250	61,000	.002033	.000033			
15,500	62,000	.002067	.000034			
15,750	63,000	.002133	.000066			
16,000	64,000	.002200	.000067			
16,250	65,000	.002233	.000033			
15,000	60,000	.004333	.002100			Elastic limit. Load fell.
15,250	61,000	.005333	.001000			
15,500	62,000	.006667	.003334			
15,750	63,000	.009167	.000500			
16,000	64,000	.009733	.000566			
16,250	65,000	.010133	.000400			
16,500	66,000	.010833	.000700			
17,000	68,000	.012167	.001334			
17,500	70,000	.013667	.001500			
18,000	72,000	.015333	.001666			
19,000	76,000	.018667	.003334			
20,000	80,000	.021667	.003000			
21,000	84,000	.025667	.004000			
22,000	88,000	.030667	.005000			
23,000	92,000	.034483	.003766			
24,000	96,000	.041067	.006634			
25,000	100,000	.049000	.007933			
26,000	104,000	.0638	.0143			
27,000	108,000	.0767	.0134			
27,720	110,880	.1267	.0500			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds ..	110,880
Elastic limit per square inch of original section	do ..	65,000
Elongation per inch after rupture	inch ..	.1667
Elongation per inch under strain at elastic limit	do ..	.002233
Reduction in diameter at point of rupture	do ..	.084
Reduction in area after rupture, per cent of original section	do ..	27.6
Position of rupture		1/8 in. from neck
Character of broken surface		fine granular with silky center
Elongation of inch sections		" .12, ".26, ".13

CRUCIBLE STEEL.

No. 5383.

Marks, 43.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000200	.000200	0.	0.	
5,000	20,000	.000333	.000333	0.	0.	
7,500	30,000	.000467	.000334	0.	0.	
10,000	40,000	.001300	.000333	0.	0.	
10,250	41,000	.001833	.000333	0.	0.	
10,500	42,000	.001967	.000334	0.	0.	
10,750	43,000	.001400	.000333	0.	0.	
11,000	44,000	.001733	.000333	0.	0.		Elastic limit.
11,250	45,000	.001933	.000200	0.	0.	
11,500	46,000	.002133	.000200	0.	0.	
11,750	47,000	.002400	.000267	0.	0.	
12,000	48,000	.002733	.000333	0.	0.	
12,250	49,000	.003067	.000334	0.	0.	
12,500	50,000	.003600	.000333	0.	0.	
13,000	52,000	.004333	.000733	0.	0.	
13,500	54,000	.005467	.001134	0.	0.	
14,000	56,000	.007333	.001866	0.	0.	
14,500	58,000	.012333	.005000	0.	0.	
15,000	60,000	.013267	.009984	0.	0.	
15,500	62,000	.014667	.001400	0.	0.	
16,000	64,000	.016000	.001333	0.	0.	
16,500	66,000	.017933	.001933	0.	0.	
17,000	68,000	.019400	.001467	0.	0.	
17,500	70,000	.021667	.002267	0.	0.	
18,000	72,000	.023333	.001666	0.	0.	
18,500	74,000	.025667	.002334	0.	0.	
19,000	76,000	.028167	.002500	0.	0.	
19,500	78,000	.031333	.003166	0.	0.	
20,000	80,000	.034000	.002667	0.	0.	
20,500	82,000	.037333	.003333	0.	0.	
21,000	84,000	.042000	.004667	0.	0.	
21,500	86,000	.0500	.0080	0.	0.	
22,000	88,000	.0567	.0067	0.	0.	
22,500	90,000	.0667	.0100	0.	0.	
23,000	92,000	.0667	.0200	0.	0.	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	92,000
Elastic limit per square inch of original section.....	do..	43,000
Elongation per inch after rupture.....	inch..	.1900
Elongation per inch under strain at elastic limit.....	do..	.001400
Reduction in diameter at point of rupture.....	do..	.234
Reduction in area after rupture, per cent of original section.....		66.0
Position of rupture.....		1".27 from neck
Character of broken surface.....	fine, silky; cup shaped	
Elongation of inch sections.....		".04, ".16, ".37*

CRUCIBLE STEEL.

DUPLICATE OF No. 5383.

No. 5398.

Marks, 43 D.
 Diameter, ".564
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....
2,500	10,000	.000200	.000200	.....	.....
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.000967	.000334	.....	.....
10,000	40,000	.001333	.000366	.....	.....
10,250	41,000	.001367	.000334	.....	.....
10,500	42,000	.001400	.000333	.....	.....
10,750	43,000	.001433	.000333	.....	.....
11,000	44,000	.001500	.000467	.....	.....
11,250	45,000	.001567	.000467	.....	.....
11,500	46,000	.001633	.000466	.....	.....
11,750	47,000	.001667	.000334	Elastic limit.
12,000	48,000	.001667	.000200	.....	.....
12,250	49,000	.002000	.000133	.....	.....
12,500	50,000	.002267	.000267	.000467	.000467	
12,750	51,000	.002600	.000333	.....	.....
13,000	52,000	.002867	.003267	.....	.....
13,250	53,000	.003083	.000166	.....	.....
13,500	54,000	.003500	.000467	.....	.....
14,000	56,000	.004300	.000800	.....	.....
14,500	58,000	.005200	.000900	.....	.....
15,000	60,000	.006067	.000867	.....	.....
15,500	62,000	.007000	.000833	.....	.....
16,000	64,000	.008100	.001100	.....	.....
16,500	66,000	.009600	.001400	.....	.....
17,000	68,000	.010633	.001133	.....	.....
17,500	70,000	.011967	.001334	.....	.....
18,000	72,000	.013388	.001366	.....	.....
18,500	74,000	.014600	.001267	.....	.....
19,000	76,000	.016000	.001400	.....	.....
19,500	78,000	.017500	.001500	.....	.....
20,000	80,000	.019067	.001567	.....	.....
20,500	82,000	.020667	.001900	.....	.....
21,000	84,000	.022333	.001866	.....	.....
21,500	86,000	.024767	.001934	.....	.....
22,000	88,000	.027000	.002333	.....	.....
22,500	90,000	.029167	.002167	.....	.....
23,000	92,000	.031800	.002633	.....	.....
23,500	94,000	.034333	.002533	.....	.....
24,000	96,000	.0400	.005667	.....	.....
24,500	98,000	.0467	.0067	.....	.....
25,000	100,000	.0533	.0066	.....	.....
26,000	104,000	.0667	.0134	.....	.....
26,680	106,720	1133	.0466	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,720
Elastic limit per square inch of original section	do ..	47,000
Elongation per inch after rupture	inch ..	.1933
Elongation per inch under strain at elastic limit	do ..	.001667
Reduction in diameter at point of rupture	do ..	.174
Reduction in area after rupture, per cent of original section .....	.....	52.2
Position of rupture .....	.....	" .95 from neck
Character of broken surface .....	.....	fine silky; cup-shaped ends
Elongation of inch sections .....	.....	" .85", ".12", ".11

CRUCIBLE STEEL.

ANNEALED IN COAL FURNACE.

No. 5384.

Marks, 42.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
210	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000333	.000200			
5,000	20,000	.000667	.000334			
7,500	30,000	.001033	.000566			
10,000	40,000	.001400	.000387	.000033	.000033	
10,250	41,000	.001433	.000633			Elastic limit.
10,500	42,000	.001500	.003900			
10,750	43,000	.001600	.002700			
11,000	44,000	.001633	.005900			
11,250	45,000	.001667	.004400			
11,500	46,000	.010000	.000600			
11,750	47,000	.011000	.001000			
12,000	48,000	.011500	.000500			
12,250	49,000	.012167	.000667			
12,500	50,000	.013007	.000900			
13,000	52,000	.014500	.001433			
13,500	54,000	.016200	.001700			
14,000	56,000	.018267	.002067			
14,500	58,000	.019733	.001466			
15,000	60,000	.021700	.001967			
15,500	62,000	.023833	.002133			
16,000	64,000	.026333	.002500			
16,500	66,000	.028333	.002900			
17,000	68,000	.031167	.002834			
17,500	70,000	.033833	.002666			
18,000	72,000	.036667	.002834			
18,500	74,000	.040007	.004000			
19,000	76,000	.0467	.006033			
20,000	80,000	.0567	.0100			
21,000	84,000	.0733	.0166			
22,000	88,000	.1033	.0300			
23,260	89,040	.1433	.0400			Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	89,040
Elastic limit per square inch of original section.....	do...	41,000
Elongation per inch after rupture.....	inch.....	.2000
Elongation per inch under strain at elastic limit.....	do.....	.001433
Reduction in diameter at point of rupture.....	do.....	.114
Reduction in area after rupture, per cent of original section.....		36.4
Position of rupture.....		1" from neck
Character of broken surface.....		silky, with trace of granulation
Elongation of inch sections.....		"31", ".18", ".12

CRUCIBLE STEEL.

No. 5471.

Marks, 51.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gaged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133			
2,500	10,000	.000300	.000167			
5,000	20,000	.000667	.000367			
7,500	30,000	.001000	.000333			
10,000	40,000	.001333	.000333	.000000	.000000	
12,500	50,000	.001700	.000367	.000033	.000033	
14,500	58,000	.001967	.000267			
14,750	59,000	.002000	.000033			Elastic limit.
15,000	60,000	.003333	.001333			Load fell.
13,250	53,000	.004267	.000934			
13,500	54,000	.004500	.000213			
13,750	55,000	.006333	.001833			
14,000	56,000	.010667	.004334			
14,250	57,000	.011400	.000733			
14,500	58,000	.011833	.000433			
14,750	59,000	.012267	.000434			
15,000	60,000	.013333	.001166			
15,500	62,000	.014867	.001534			
16,000	64,000	.017000	.002133			
16,500	66,000	.019000	.002000			
17,000	68,000	.021000	.002000			
17,500	70,000	.023433	.002433			
18,000	72,000	.025800	.002167			
18,500	74,000	.028000	.002400			
19,000	76,000	.030667	.002667			
19,500	78,000	.034667	.004000			
20,000	80,000	.037667	.003000			
21,000	84,000	.0467	.009033			
22,000	88,000	.0600	.0133			
23,000	92,000	.0800	.0200			
23,790	95,160	.1400	.0600			Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	95,160
Elastic limit per square inch of original section.....	do...	59,000
Elongation per inch after rupture.....	inch...	.1900
Elongation per inch under strain at elastic limit.....	do...	.002000
Reduction in diameter at point of rupture.....	do...	.104
Reduction in area after rupture, per cent of original section.....		33.5
Position of rupture.....	1".00 from neck	
Character of broken surface.....	fine silky	
Elongation of inch sections.....	"13, "18, "26*	

CRUCIBLE STEEL.

No. 5480.

Marks, 52.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000123	.000133				
2,500	10,000	.000333	.000200				
5,000	20,000	.000700	.000367				
7,500	30,000	.001000	.000800				
10,000	40,000	.001367	.000867				
11,250	45,000	.001567	.000200				
12,500	50,000	.001700	.000133				
15,000	60,000	.002100	.000400				
17,000	68,000	.002333	.000233				
15,750	63,000	.006333	.004000				Elastic limit. Load fell.
16,000	64,000	.006000	.002667				
16,250	65,000	.010000	.001000				
16,500	66,000	.010567	.000567				
16,750	67,000	.011000	.000433				
17,000	68,000	.011833	.000933				
17,250	69,000	.012500	.000567				
17,500	70,000	.012600	.001100				
18,000	72,000	.015400	.001800				
18,500	74,000	.018900	.001500				
19,000	76,000	.018000	.001100				
19,500	78,000	.020333	.002333				
20,000	80,000	.022467	.002134				
21,000	84,000	.0300	.007533				
22,000	88,000	.0333	.0033				
23,000	92,000	.0400	.0067				
24,000	96,000	.0500	.0100				
25,000	100,000	.0633	.0133				
26,000	104,000	.0833	.0300				
26,360	105,440	.1267	.0324			Tensile strength.	

General summary.

Tensile strength per square inch of original section.....	pounds..	105,440
Elastic limit per square inch of original section.....	do..	68,000
Elongation per inch after rupture.....	inch..	.1300
Elongation per inch under strain at elastic limit.....	do..	.002333
Reduction in diameter at point of rupture.....	do..	.044
Reduction in area after rupture, percent of original section.....		15.0
Position of rupture.....		1" .65 from neck
Character of broken surface.....		fine granular, dull silky center
Elongation of inch sections.....		".12, ".17, ".10

CRUCIBLE STEEL.

No. 5483.

Marks, 55.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000133	.000133	0.	.....
2,500	10,000	.000300	.000167	0.	.....
5,000	20,000	.000700	.000400	.....	.....
7,500	30,000	.001067	.000867	.....	.....
10,000	40,000	.001400	.000833	0.	.....
12,500	50,000	.001767	.000867	.....	.....
15,000	60,000	.002200	.000433	.000100	.000100	Elastic limit.
15,250	61,000	.002200	.001000	.....	.....
15,500	62,000	.002333	.001133	.....	.....
15,750	63,000	.002667	.000834	.....	.....
16,000	64,000	.002267	.000600	.....	.....
16,250	65,000	.002667	.000400	.....	.....
16,500	66,000	.002200	.000533	.....	.....
16,750	67,000	.002667	.000667	.....	.....
17,000	68,000	.002333	.000466	.....	.....
17,500	70,000	.0100	.000667	.....	.....
18,500	74,000	.0133	.0033	.....	.....
19,500	78,000	.0167	.0034	.....	.....
20,500	82,000	.0200	.0033	.....	.....
21,500	86,000	.0200+	.0000+	.....	.....
22,500	90,000	.0233	.0033	.....	.....
23,500	94,000	.0267	.0034	.....	.....
24,500	98,000	.0300	.0033	.....	.....
25,500	102,000	.0333	.0033	.....	.....
26,500	106,000	.0400	.0067	.....	.....
27,500	110,000	.0433	.0033	.....	.....
28,500	114,000	.0533	.0100	.....	.....
29,500	118,000	.0633	.0100	.....	.....
30,500	122,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	122,000
Elastic limit per square inch of original section.....	do.....	60,000
Elongation per inch after rupture.....	inch.....	.08000
Elongation per inch under strain at elastic limit.....	do.....	.002200
Reduction in diameter at point of rupture.....	do.....	.034
Reduction in area after rupture, per cent of original section.....	.....	11.8
Position of rupture.....	.....	".85 from neck
Character of broken surface.....	.....	fine granular; two small, dull gray eccentric spots, each about ".05 diameter.
Elongation of inch sections.....	.....	".11", ".09", ".07

NICKEL STEEL

INGOT No. 1, SPECIALLY TREATED.

No. 5399.

Marks, 45.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000300	.000200	0.	0.	
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.000967	.000334	.....	.....
10,000	40,000	.001333	.000366	0.	.....
12,500	50,000	.001633	.000300	.....	.....
15,000	60,000	.001967	.000334	0.	.....
17,500	70,000	.002333	.000366	0.	.....
20,000	80,000	.002667	.000334	0.	.....
22,500	90,000	.003033	.000366	0.	.....
22,750	91,000	.003067	.000034	.....	.....
23,000	92,000	.003100	.000033	.....	.....
21,250	85,000	.004367	.001267	.....	.....
21,500	86,000	.004600	.000233	.....	.....
22,000	88,000	.006667	.002067	.....	.....
22,500	90,000	.023667	.017000	.....	.....
23,000	92,000	.028667	.005000	.....	.....
23,500	94,000	.033667	.005000	.....	.....
24,000	96,000	.040167	.006500	.....	.....
24,500	98,000	.0500	.009633	.....	.....
25,000	100,000	.0600	.0100	.....	.....
25,500	102,000	.0767	.0167	.....	.....
26,890	103,560	.1133	.0366	.....	.....
						Elastic limit.
						Load fell.
						Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	103,560
Elastic limit per square inch of original section	do...	92,000
Elongation per inch after rupture	inch...	.2200
Elongation per inch under strain at elastic limit	do...	.063100
Reduction in diameter at point of rupture	do...	.224
Reduction in area after rupture, per cent of original section .....	.....	63.7
Position of rupture .....	.....	1".67 from neck
Character of broken surface .....	.....	fine silky, serrated, cup-shaped ends
Elongation of inch sections .....	.....	" .14, " .41", " .11

NICKEL STEEL.

INGOT No. 1, SIMPLY ANNEALED.

No. 5400.

Marks, 46.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	-----	
2,500	10,000	.000267	.000167	-----	-----	
5,000	20,000	.000600	.000333	-----	-----	
7,500	30,000	.000967	.000367	-----	-----	
10,000	40,000	.001300	.000333	0.	-----	
12,500	50,000	.001633	.000333	-----	-----	
15,000	60,000	.001967	.000334	-----	-----	
16,500	66,000	.002167	.000200	-----	-----	
16,750	67,000	.002200	.000033	-----	-----	
14,750	59,000	.004033	.001833	-----	-----	
15,000	60,000	.004200	.000167	-----	-----	
15,250	61,000	.005667	.001467	-----	-----	
15,500	62,000	.013667	.008000	-----	-----	
15,750	63,000	.015333	.001666	-----	-----	
16,000	64,000	.016333	.001000	-----	-----	
16,500	66,000	.019333	.003000	-----	-----	
17,000	68,000	.022000	.002667	-----	-----	
17,500	70,000	.025333	.003833	-----	-----	
18,000	72,000	.030000	.004167	-----	-----	
18,500	74,000	.034333	.004333	-----	-----	
19,000	76,000	.039000	.004667	-----	-----	
19,500	78,000	.044667	.005667	-----	-----	
20,000	80,000	.0567	.012033	-----	-----	
20,500	82,000	.0633	.0066	-----	-----	
21,000	84,000	.0733	.0100	-----	-----	
21,500	86,000	.0933	.0200	-----	-----	
21,930	87,720	.1333	.0400	-----	-----	
						Elastic limit.
						Load fell.
						Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	87,720
Elastic limit per square inch of original section.....	do...	67,000
Elongation per inch after rupture.....	inch....	.2167
Elongation per inch under strain at elastic limit.....	do....	.002200
Reduction in diameter at point of rupture.....	do....	.154
Reduction in area after rupture, per cent of original section.....		47.2
Position of rupture.....		1".12 from neck
Character of broken surface.....		silky; longitudinal cavity near axis of specimen ".05x".02; length not known.
Elongation of inch sections.....		".33", ".21", ".11

NICKEL STEEL.

INGOT NO. 2, SPECIALLY TREATED.

No. 5401.

Marks, 47.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....
2,500	10,000	.000300	.000200	.....	.....
5,000	20,000	.000633	.000333	.....	.....
7,500	30,000	.000987	.000324	.....	.....
10,000	40,000	.001200	.000333	0.	.....
12,500	50,000	.001687	.000387	.....	.....
15,000	60,000	.002000	.000333	0.	.....
17,500	70,000	.002333	.000333	.....	.....
20,000	80,000	.002887	.000334	0.	.....
21,000	84,000	.002800	.000133	.....	.....	Elastic limit.
21,250	85,000	.003000	.000200	.....	.....	Load fell.
20,500	82,000	.003500	.000500	.....	.....
20,750	83,000	.004333	.000633	.....	.....
21,000	84,000	.015887	.011334	.....	.....
21,250	85,000	.017000	.001333	.....	.....
21,500	86,000	.018333	.001333	.....	.....
22,000	88,000	.023333	.005000	.....	.....
22,500	90,000	.027000	.003667	.....	.....
23,000	92,000	.032500	.005500	.....	.....
23,500	94,000	.037000	.004500	.....	.....
24,000	96,000	.0487	.0097	.....	.....
24,500	98,000	.0583	.0066	.....	.....
25,000	100,000	.0633	.0100	.....	.....
25,500	102,000	.0800	.0167	.....	.....
25,810	103,240	.1133	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	103,240
Elastic limit per square inch of original section	do...	84,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.002800
Reduction in diameter at point of rupture	do...	.234
Reduction in area after rupture, per cent of original section	do...	65.8
Position of rupture	1".13 from neck	
Character of broken surface	fine, silky, serrated; cup-shaped ends	
Elongation of inch sections	" .10, ".18, ".87"	

NICKEL STEEL.

INGOT No. 2, SIMPLY ANNEALED.

No. 5402.

Marks, 48.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000067	.000067	0.	0.	
2,500	10,000	.000200	.000233	.....	.....
5,000	20,000	.000633	.000833	.....	.....
7,500	30,000	.000967	.000334	.....	.....
10,000	40,000	.001300	.000333	0.	.....
12,500	50,000	.001667	.000367	.....	.....
14,500	58,000	.001867	.000200	.....	.....
13,750	55,000	.004000	.002133	.....	.....
14,000	56,000	.005667	.001667	.....	.....
14,250	57,000	.008500	.002333	.....	.....
14,500	58,000	.009500	.001000	.....	.....
14,750	59,000	.010333	.000833	.....	.....
15,000	60,000	.012667	.002334	.....	.....
15,500	62,000	.013933	.001266	.....	.....
16,000	64,000	.015833	.001900	.....	.....
16,500	66,000	.018333	.002500	.....	.....
17,000	68,000	.021167	.002334	.....	.....
17,500	70,000	.023333	.002166	.....	.....
18,000	72,000	.026333	.003000	.....	.....
18,500	74,000	.029333	.003000	.....	.....
19,000	76,000	.033500	.004167	.....	.....
19,500	78,000	.036667	.002167	.....	.....
20,000	80,000	.040667	.004000	.....	.....
20,500	82,000	.0467	.006033	.....	.....
21,000	84,000	.0567	.0100	.....	.....
21,500	86,000	.0633	.0066	.....	.....
22,000	88,000	.0700	.0067	.....	.....
22,500	90,000	.0867	.0187	.....	.....
23,000	92,000	.1167	.0300	.....	.....
						Elastic limit. Load fell.
						Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,000
Elastic limit per square inch of original section	do ..	58,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do ..	.001867
Reduction in diameter at point of rupture	do ..	.194
Reduction in area after rupture, per cent of original section		57.0
Position of rupture .....		.85 from neck
Character of broken surface	fine, silky; cup-shaped ends	
Elongation of inch sections		".41", ".14", ".10

NICKEL STEEL.

No. 5520.

Marks, 58-2.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	.....
2,500	10,000	.000200	.000200	.....	.....
5,000	20,000	.000333	.000333	.....	.....
7,500	30,000	.001000	.000367	.....	.....
10,000	40,000	.001267	.000367	0.	.....
12,500	50,000	.001667	.000300	.....	.....
15,000	60,000	.002000	.000333	0.	.....
16,750	67,000	.002200	.000200	.....	.....
17,000	68,000	.002233	.000033	.....	.....
17,250	69,000	.003367	.003367	.....	.....
16,500	66,000	.....	.....	.....	.....
16,750	67,000	.005733	.000133	.....	.....
17,000	68,000	.006367	.000633	.....	.....
17,250	69,000	.007000	.000633	.....	.....
17,500	70,000	.007400	.000400	.....	.....
18,000	72,000	.008000	.000600	.....	.....
18,500	74,000	.008000	.001000	.....	.....
19,000	76,000	.010000	.001000	.....	.....
19,500	78,000	.011067	.001067	.....	.....
20,000	80,000	.012167	.001100	.....	.....
21,000	84,000	.014100	.001933	.....	.....
22,000	88,000	.016000	.001900	.....	.....
22,000	88,000	.018900	.002900	.....	.....
23,000	92,000	.020667	.001767	.....	.....
24,000	96,000	.024000	.003333	.....	.....
25,000	100,000	.027867	.003967	.....	.....
26,000	104,000	.030167	.002500	.....	.....
27,000	108,000	.034667	.004500	.....	.....
28,000	112,000	.040000	.005333	.....	.....
29,000	116,000	.046667	.006667	.....	.....
30,000	120,000	.055000	.008333	.....	.....
31,000	124,000	.0733	.0183	.....	.....
31,580	126,320	.1067	.0334	.....	.....
						Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	126,320
Elastic limit per square inch of original section.....	do..	68,000
Elongation per inch after rupture.....	inch..	.1333
Elongation per inch under strain at elastic limit.....	do..	.002233
Reduction in diameter at point of rupture.....	do..	.054
Reduction in area after rupture, per cent of original section.....	do..	18.3
Position of rupture.....		1/16 from neck
Character of broken surface.....		fine granular, radiating from a dull spot at the circumference where a punch mark defined the first inch section.
Elongation of inch sections.....		".13, ".17, ".10

NICKEL STEEL.

No. 5521.

Marks, 59-3.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100			
2,500	10,000	.000300	.000200			
5,000	20,000	.000633	.000533			
7,500	30,000	.000967	.000834			
10,000	40,000	.001800	.000333	0.		
12,500	50,000	.001667	.000367			
15,000	60,000	.002000	.000333	0.		
16,500	66,000	.002300	.000300			
16,750	67,000	.002333	.000033			
17,000	68,000	.002367	.000034			
17,250	69,000	.002433	.000066			
17,500	70,000	.002467	.000034	0.		
17,750	71,000	.002533	.000066			
18,000	72,000	.002567	.000034			
18,250	73,000	.002600	.000033			
18,500	74,000	.002633	.000033			
18,750	75,000	.002667	.000034			
19,000	76,000	.002733	.000066			
19,250	77,000	.002867	.000134			
19,500	78,000	.006000	.003133			
19,750	79,000	.006600	.000600			
19,750	79,000	.007033	.000433			
20,000	80,000	.007600	.000567			
20,500	82,000	.008600	.001000			
21,000	84,000	.009000	.000400			
21,500	86,000	.010000	.001000			
22,000	88,000	.011000	.001000			
23,000	92,000	.013000	.002000			
24,000	96,000	.015167	.002167			
25,000	100,000	.017167	.002000			
26,000	104,000	.019200	.002033			
27,000	108,000	.021667	.002467			
28,000	112,000	.024333	.002666			
29,000	116,000	.026967	.002834			
30,000	120,000	.029333	.002366			
31,000	124,000	.0333	.003067			
32,000	128,000	.0400	.0067			
33,000	132,000	.0467	.0067			
34,000	136,000	.0533	.0066			
35,000	140,000	.0700	.0167			
35,340	141,360	.0900	.0200			
						Elastic limit.
						Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	141,360
Elastic limit per square inch of original section	do...	76,000
Elongation per inch after rupture	inch..	.0900
Elongation per inch under strain at elastic limit	do...	.002733
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		1".23 from neck
Character of broken surface		fine granular, radiating from center punch mark defining inch section
Elongation of inch sections		".09, ".10, ".08

NICKEL CRUCIBLE STEEL, OIL-TEMPERED AND ANNEALED.

No. 5481.

Marks, 53.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000333	.000200	0.	0.	
5,000	20,000	.000700	.000367	0.	0.	
7,500	30,000	.001033	.000333	0.	0.	
10,000	40,000	.001400	.000367	0.	0.	
12,500	50,000	.001733	.000333	0.	0.	
15,000	60,000	.002067	.000334	0.	0.	
17,500	70,000	.002400	.000333	0.	0.	
20,000	80,000	.002767	.000367	0.	0.	
22,500	90,000	.003100	.000333	.000033	.000033	Elastic limit.
23,500	94,000	.003293	.000133	0.	0.	
23,750	95,000	.003267	.000034	0.	0.	
24,000	96,000	.003467	.000200	0.	0.	
24,250	97,000	.003733	.000266	0.	0.	
24,500	98,000	.006000	.002267	0.	0.	
24,750	99,000	.008000	.002000	0.	0.	
25,000	100,000	.0100	.0020	0.	0.	
26,000	104,000	.0200	.0100	0.	0.	
27,000	108,000	.0267	.0067	0.	0.	
28,000	112,000	.0367	.0100	0.	0.	Tensile strength.
29,000	118,000	.0500	.0133	0.	0.	
30,000	120,000	.0800	.0300	0.	0.	

General summary.

Tensile strength per square inch of original section pounds.. 120,000
 Elastic limit per square inch of original section do... 95,000
 Elongation per inch after rupture inch... .1733
 Elongation per inch under strain at elastic limit do... .003267
 Reduction in diameter at point of rupture do... .184
 Reduction in area after rupture, per cent of original section 54.6
 Position of rupture ".90 from neck
 Character of broken surface fine silky; cup-shaped ends
 Elongation of inch sections ".36", ".10", ".06

NICKEL CRUCIBLE STEEL, OIL TEMPERED AND ANNEALED.

No. 5482.

Marks, 54.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
250.	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000133	.000133	0.	0.		
2,500	10,000	.000300	.000167				
5,000	20,000	.000667	.000167				
7,500	30,000	.001033	.000366				
10,000	40,000	.001333	.000300	0.			
12,500	50,000	.001667	.000384				
15,000	60,000	.002000	.000333				
17,500	70,000	.002367	.000387	0.			
20,000	80,000	.002700	.000333	0.			
22,500	90,000	.003067	.000387	0.			
23,000	92,000	.003167	.000100				
23,250	93,000	.003233	.000066				
23,500	94,000	.003367	.000134				
23,750	95,000	.003633	.000266	.000333	.000333		Elastic limit.
24,000	96,000	.004167	.000534				
24,250	97,000	.005500	.001333				
24,500	98,000	.0100	.0045				
25,000	100,000	.0167	.0067				
26,000	104,000	.0267	.0100				
27,000	108,000	.0333	.0066				
28,000	112,000	.0433	.0100				
29,000	116,000	.0600	.0167				
29,920	119,680	.1000	.0400			Tensile strength.	

General summary.

Tensile strength per square inch of original section.....pounds.. 119,680
 Elastic limit per square inch of original section.....do... 93,000
 Elongation per inch after rupture.....inch... .1833
 Elongation per inch under strain at elastic limit.....do... .003233
 Reduction in diameter at point of rupture.....do... .184
 Reduction in area after rupture, per cent of original section.....do... 54.6
 Position of rupture.....1" from neck
 Character of broken surface.....fine silky; cup-shaped ends
 Elongation of inch sections.....".08, ".12, ".35"

Marks, 49.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3."

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000667	.000367			
7,500	30,000	.001000	.000333			
10,000	40,000	.001333	.000333	0.		
12,500	50,000	.001667	.000334			
15,000	60,000	.002000	.000333	0.		
16,250	65,000	.002133	.000133			
16,500	66,000	.002967	.000334			
						Elastic limit.
16,000	64,000	.005500	.002533			Load fell.
16,250	65,000	.007033	.001533			
17,000	68,000	.008767	.001734			
17,500	70,000	.010333	.001566			
18,000	72,000	.011867	.001334			
18,500	74,000	.013000	.001333			
19,000	76,000	.014500	.001500			
19,500	78,000	.016167	.001667			
20,000	80,000	.017500	.001333			
20,500	82,000	.019000	.001500			
21,000	84,000	.020667	.001667			
21,500	86,000	.022333	.001666			
22,000	88,000	.024333	.002000			
22,500	90,000	.025667	.001334			
23,000	92,000	.028333	.002866			
23,500	94,000	.030667	.002334			
24,000	96,000	.034000	.002333			
24,500	98,000	.035333	.002333			
25,000	100,000	.038333	.003000			
26,000	104,000	.0467	.008367			
27,000	108,000	.0567	.0100			
28,000	112,000	.0767	.0200			
28,020	114,460	.1133	.0366			Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	114,480
Elastic limit per square inch of original section.....	do.	65,000
Elongation per inch after rupture.....	inch..	.1767
Elongation per inch under strain of elastic limit.....	do.	.002133
Reduction in diameter at point of rupture.....	do.	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture.....		1." 55 from neck
Character of broken surface.....	silky, interspersed with fine granulation	
Elongation of inch sections	" 11," 28," 14	

No. 5526.

METAL AS RECEIVED FROM THE MANUFACTURERS.

Marks, 49.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000367	.000234			
5,000	20,000	.000733	.000366			
7,500	30,000	.001067	.000334			
10,000	40,000	.001433	.000366	0.		
12,500	50,000	.001800	.000367			
15,000	60,000	.002133	.000333	.000033	.000033	
17,000	68,000	.002400	.000267			
17,250	68,000	.002467	.000067			Elastic limit. Load fell.
16,500	66,000	.003700	.001233			
16,750	67,000	.004167	.000467			
17,000	68,000	.006200	.002033			
17,250	68,000	.006833	.000633			
17,500	70,000	.007567	.000734			
17,750	71,000	.008000	.000433			
18,000	72,000	.009000	.001000			
19,000	76,000	.0133	.0043			
20,000	80,000	.0167	.0034			
21,000	84,000	.0200	.0033			
22,000	88,000	.0233	.0033			
23,000	92,000	.0267	.0034			
24,000	96,000	.0300	.0033			
25,000	100,000	.0333	.0033			
26,000	104,000	.0367	.0034			
27,000	108,000	.0433	.0066			
28,000	112,000	.0500	.0067			
29,000	116,000	.0533	.0123			
30,000	120,000	.0600	.0267			
30,120	120,480	.1100	.0200			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds ..	120,480
Elastic limit per square inch of original section	do ..	68,000
Elongation per inch after rupture	inch ..	.1733
Elongation per inch under strain at elastic limit	do ..	.002467
Reduction in diameter at point of rupture	do ..	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		at middle of stem
Character of broken surface		fine silky, with trace of granulation
Elongation of inch sections		".12, ".29, ".11

METAL AS RECEIVED FROM THE MANUFACTURERS.

Marks, 49.

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000100	.000100	0.	0.		
2,000	10,000	.000200	.000200				
4,000	20,000	.000367	.000367				
6,000	30,000	.001000	.000333				
8,000	40,000	.001323	.000323				
10,000	50,000	.001700	.000367	0.			
12,000	60,000	.002067	.000367				
13,000	65,000	.002233	.001166				
14,000	70,000	.002433	.000200	0.			
14,200	71,000	.002500	.000667				
14,400	72,000	.002633	.000133				
14,000	70,000	.003200	.000567				Elastic limit.
14,200	71,000	.0048 3	.001533				
14,400	72,000	.006733	.001900				
14,600	73,000	.007133	.000400				
14,800	74,000	.007667	.000534				
15,000	75,000	.008200	.000533				
15,200	76,000	.009000	.000800	.005933	.005933		
200	1,000	.005833				Load fall.	
2,000	10,000	.006267					
4,000	20,000	.006633					
6,000	30,000	.007000					
8,000	40,000	.007367					
10,000	50,000	.007800					
12,000	60,000	.008233					
10,000	50,000	.007867					
8,000	40,000	.007500					
6,000	30,000	.007133					
4,000	20,000	.006767					
2,000	10,000	.006367					
200	1,000	.005967					
16,000	80,000	.0133	.0043				Tensile strength.
16,800	84,000	.0167	.0034				
17,600	88,000	.0200	.0033				
18,400	92,000	.0233	.0033				
19,200	96,000	.0267	.0034				
20,000	100,000	.0300	.0033				
20,800	104,000	.0333	.0033				
21,600	108,000	.0367	.0034				
22,400	112,000	.0433	.0036				
23,200	116,000	.0500	.0067				
24,000	120,000	.0633	.0133				
24,800	124,000	.0667	.0234				
24,916	124,550	.1000	.0133				

General summary.

Tensile strength per square inch of original section.....	pounds..	124,550
Elastic limit per square inch of original section.....	do ..	71,000
Elongation per inch after rupture.....	inch ..	.1633
Elongation per inch under strain at elastic limit.....	do ..	.002500
Reduction in diameter at point of rupture.....	do ..	.105
Reduction in area after rupture, per cent of original section.....		87.1
Position of rupture.....		1" .23 from neck
Character of broken surface.....		fine silky, with trace of granulation
Elongation of inch sections.....		" .10, ".17, ".23"

No. 5528.

ROLLED INTO BARREL AND COOLED IN AIR.

Marks, 49 A.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000100	.000100	0.			
2,000	10,000	.000333	.000233				
4,000	20,000	.000667	.000334				
6,000	30,000	.001033	.000366				
8,000	40,000	.001367	.000334				
10,000	50,000	.001733	.000366	0.			
12,000	60,000	.002067	.000334				
14,000	70,000	.002467	.000400	0.			
14,200	71,000	.002533	.000066				
13,800	69,000	.003033	.000500				Elastic limit. Load fell.
14,000	70,000	.003833	.000800				
14,200	71,000	.005700	.001867				
14,400	72,000	.006600	.000900				
14,600	73,000	.007300	.000700				
14,800	74,000	.007833	.000583				
15,000	75,000	.008333	.000500				
15,200	76,000	.008833	.000500				
16,000	80,000	.0133	.004467				
16,800	84,000	.0167	.0034				
17,600	88,000	.0200	.0033				
18,400	92,000	.0233	.0033				
19,200	96,000	.0267	.0034				
20,000	100,000	.0300	.0033				
20,800	104,000	.0333	.0033				
21,600	108,000	.0367	.0034				
22,400	112,000	.0400	.0033				
23,200	116,000	.0467	.0067				
24,000	120,000	.0600	.0133				
24,800	124,000	.0867	.0267				
24,870	124,350	.1000	.0133			Tensile strength.	

General summary.

Tensile strength per square inch of original section.....	pounds..	124,350
Elastic limit per square inch of original section.....	do...	71,000
Elongation per inch after rupture.....	inch...	.1467
Elongation per inch under strain at elastic limit.....	do...	.002533
Reduction in diameter at point of rupture.....	do...	.105
Reduction in area after rupture, per cent of original section.....		37.1
Position of rupture.....		.95 from neck
Character of broken surface.....		silky, interspersed with fine granulation
Elongation of inch sections.....		".09, ".11, ".24"

No. 5529.

ROLLED, AND ANNEALED IN CHARCOAL.

Marks, 49 C.

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	0.	
2,000	10,000	.000333	.000200	.....	.....
4,000	20,000	.000700	.000367	.....	.....
6,000	30,000	.001033	.000333	.....	.....
8,000	40,000	.001400	.000367	.....	.....
10,000	50,000	.001733	.000333	0.	.....
12,000	60,000	.002067	.000334	.....	.....
13,200	66,000	.002300	.000233	.....	.....
13,400	67,000	.002367	.000067	.....	.....	Elastic limit. Load fell
12,800	64,000	.003533	.001166	.....	.....
13,000	65,000	.005300	.001767	.....	.....
13,200	66,000	.006533	.001233	.....	.....
13,400	67,000	.007167	.000634	.....	.....
13,600	68,000	.007867	.000700	.....	.....
13,800	69,000	.008600	.000733	.....	.....
14,000	70,000	.009067	.000467	.....	.....
15,200	76,000	.0133	.004233	.....	.....
16,000	80,000	.0167	.0034	.....	.....
16,800	84,000	.0200	.0033	.....	.....
17,600	88,000	.0233	.0033	.....	.....
18,400	92,000	.0267	.0034	.....	.....
19,200	96,000	.0300	.0033	.....	.....
20,000	100,000	.0333	.0033	.....	.....
20,800	104,000	.0400	.0067	.....	.....
21,600	108,000	.0467	.0067	.....	.....
22,400	112,000	.0567	.0100	.....	.....
23,200	116,000	.0700	.0133	.....	.....
23,620	118,100	.1100	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds.	118,100
Elastic limit per square inch of original section.....	do.	67,000
Elongation per inch after rupture.....	inch.	.1600
Elongation per inch under strain at elastic limit.....	do.	.002367
Reduction in diameter at point of rupture.....	do.	.095
Reduction in area after rupture, per cent of original section.....		34.0
Position of rupture.....		1" 1 from neck
Character of broken surface.....		fine granular, silky center
Elongation of inch sections.....		".23", ".15", ".10

No. 5523.

Marks, 49 P.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000100	.000100	0.	0.		
2,000	10,000	.000300	.000300				
4,000	20,000	.000667	.000667				
6,000	30,000	.000967	.000967				
8,000	40,000	.001300	.001300	0.			
10,000	50,000	.001633	.001633				
12,000	60,000	.002000	.002000				
13,000	65,000	.002200	.002200				
13,200	66,000	.002233	.000333				Elastic limit.
13,400	67,000	.002367	.000134				
12,800	64,000	.003033	.000666				Load fell.
13,000	65,000	.003167	.000134				
13,200	66,000	.003800	.000633				
13,400	67,000	.006000	.002200				
13,600	68,000	.006733	.000733				
13,800	69,000	.007400	.000667				
14,000	70,000	.008167	.000767				
15,200	78,000	.0133	.005133				
16,000	80,000	.0167	.0034				
16,800	84,000	.0200	.0033				
17,600	88,000	.0233	.0033				
18,400	92,000	.0267	.0034				
19,200	96,000	.0300	.0033				
20,000	100,000	.0333	.0033				
20,800	104,000	.0367	.0034				
21,600	108,000	.0433	.0066				
22,400	112,000	.0500	.0067				
23,200	116,000	.0633	.0133				
24,000	120,000	.1100	.0467			Tensile strength.	

General summary.

Tensile strength per square inch of original section	pounds	120,000
Elastic limit per square inch of original section	do	66,000
Elongation per inch after rupture	inch	.1433
Elongation per inch under strain at elastic limit	do	.002233
Reduction in diameter at point of rupture	do	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		.7 from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		".26", ".09", ".08

No. 5470.

Marks, 50.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000333	.000200			
5,000	20,000	.000667	.000334			
7,500	30,000	.001000	.000333			
10,000	40,000	.001367	.000367	0.		
10,250	41,000	.001400	.000333			
10,500	42,000	.001433	.000333			
10,750	43,000	.001467	.000334			
11,000	44,000	.001500	.000333			
11,250	45,000	.001533	.000333			
11,500	46,000	.001567	.000334			Elastic limit.
11,750	47,000	.001600	.000286			
12,000	48,000	.002033	.000200			
12,250	49,000	.002400	.000367			
12,500	50,000	.002633	.000233	.000733	.000733	
12,750	51,000	.003000	.000367			
13,000	52,000	.003300	.000300			
13,250	53,000	.003567	.000287			
13,500	54,000	.004000	.000433			
14,000	56,000	.004833	.000833			
14,500	58,000	.005933	.001100			
15,000	60,000	.006667	.000734			
15,500	62,000	.008000	.001333			
16,000	64,000	.009000	.001000			
16,500	66,000	.010233	.001233			
17,000	68,000	.011500	.001267			
17,500	70,000	.013000	.001500			
18,000	72,000	.014433	.001433			
18,500	74,000	.015733	.001300			
19,000	76,000	.017367	.001634			
19,500	78,000	.019000	.001633			
20,000	80,000	.020967	.001967			
21,000	84,000	.0233	.002333			
22,000	88,000	.0267	.0034			
23,000	92,000	.0333	.0066			
24,000	96,000	.0400	.0067			
25,000	100,000	.0567	.0167			
25.930	103,720	.1067	.0500			Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	103,720
Elastic limit per square inch of original section.....	do....	46,000
Elongation per inch after rupture.....	inch....	.1800
Elongation per inch under strain at elastic limit.....	do....	.001567
Reduction in diameter at point of rupture.....	do....	.124
Reduction in area after rupture, per cent of original section.....	.....	39.2
Position of rupture.....	.....	1".46 from neck
Character of broken surface.....	.....	silky
Elongation of inch sections.....	.....	".11."29"."14

TABULATION OF TENSION SPECIMENS FROM RIFLE-BARREL STEEL (LENGTH OF STEMS 3").

No. of test.	Mark on specimen.	Diameter.	Sec-tional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 3 inches.	Con-traction of area.	Appearance of fracture.	Elongation of inch sections.	Remarks.
		Inch.	Sq. in.	Pounds.	Pounds.	Per ct.	Per ct.			
5385	44	.564	.25	65,000	110,880	16.7	57.6	Fine granular, with silky center.	12, 25, 13	
5383	43	.564	.25	43,000	92,000	19.0	66.0	Fine silky, cup shaped	.04, 16, .37*	
5386	43 D	.564	.25	47,000	105,720	19.3	52.2	do	.35, 12, .11	
5384	42 A	.564	.25	41,000	89,040	20.0	36.4	Silky, with trace of granulation.	.31, .18, .12	Annealed in coal furnace.
5471	51	.564	.25	59,000	95,160	19.0	32.5	Fine silky	12, 18, .26*	
5480	52	.564	.25	68,000	105,440	13.0	15.0	Fine granular, dull silky center.	12, 17, .10	
5483	53	.564	.25	60,000	122,000	9.0	11.8	Fine granular. Two small dull gray eccentric spots, each about .06 diameter.	.11, .06, .07	
5399	45	.564	.25	92,000	103,560	22.0	63.7	Fine silky, serrated, cup-shaped ends.	.14, .41*, .11	Nickel steel; ingot No. 1 specially treated.
5400	46	.564	.25	67,000	87,720	21.7	47.2	Silky. Longitudinal cavity near axis of specimen .05 by .02 length not known.	.35*, 21, .11	Nickel steel; ingot No. 1 simply annealed.
5401	47	.564	.25	84,000	103,240	21.7	65.8	Fine silky, serrated, cup shaped.	.10, .18, .37*	Nickel steel; ingot No. 2 specially treated.
5402	48	.564	.25	58,000	92,000	21.7	57.0	Fine silky, cup shaped.	.41*, 14, .10	Nickel steel; ingot No. 2 simply annealed.
5520	58-2	.564	.25	68,000	136,320	13.3	18.3	Fine granular, radiating from a dull spot at the circumference, where a punch mark defined the first inch section.	.13, .17*, .10	Nickel steel.
5521	58-3	.564	.25	76,000	141,360	9.0	11.6	Fine granular, radiating from center punch mark defining inch section.	.09*, 10*, .08	Do.
5481	53	.564	.25	85,000	120,000	17.3	54.6	Fine silky, cup shaped.	.36*, 10, .06	Nickel steel; oil tempered and annealed.
5482	54	.564	.25	93,000	119,680	18.3	54.6	do	.08, 12, .35*	
5403	49	.564	.25	65,000	114,480	17.7	33.5	Silky, interspersed with fine granulation.	.11, .28*, .14	
5526	49	.561	.25	69,000	120,480	17.3	39.2	Fine silky, with trace of granulation.	.12, .29*, .11	As received from the manufacturers.
5527	49	.505	.20	71,000	124,550	16.3	37.1	do	.10, 17, .22*	Do.
5528	49 A	.505	.20	71,000	124,350	14.7	37.1	Silky, interspersed with fine granulation.	.09, .11, .24*	Rolled into barrel and cooled in air.
5529	49 C	.505	.20	67,000	118,100	16.0	34.0	Fine granular, silky center.	.23*, 15, .10	Rolled and annealed in charcoal.
5523	49 P	.505	.20	66,000	120,000	14.3	37.1	Silky, trace of granulation	.26*, 09, .08	
5470	50	.564	.25	46,000	103,720	18.0	39.2	Silky	.11, .29*, .14	

**RIFLE-BARREL STEEL, SUBJECTED TO SPECIAL
TREATMENT AFTER ROLLING.**



No. 5484.

Marks, 49.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000333	.000200			
5,000	20,000	.000733	.000400			
7,500	30,000	.001033	.000800			
10,000	40,000	.001400	.000967			
12,500	50,000	.001733	.000933	0.		
15,000	60,000	.002100	.000367			
16,250	65,000	.002267	.000167			
16,750	67,000	.002333	.000066			Elastic limit.
17,000	68,000	.002533	.000200			
17,250	69,000	.004700	.002167			
17,500	70,000	.006867	.002167			
17,750	71,000	.007233	.000366			
18,000	72,000	.007900	.000667			
18,250	73,000	.008367	.000467			
18,500	74,000	.009200	.000833			
19,000	76,000	.0100	.0008			
20,000	80,000	.0133	.0033			
21,000	84,000	.0167	.0074			
22,000	88,000	.0200	.0038			
23,000	92,000	.0233	.0033			
24,000	96,000	.0267	.0034			
25,000	100,000	.0300	.0033			
26,000	104,000	.0367	.0067			
27,000	108,000	.0400	.0033			
28,000	112,000	.0500	.0100			
29,000	116,000	.0633	.0133			
30,000	120,000	.0867	.0234			
30,140	120,560	.1067	.0200			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,560
Elastic limit per square inch of original section	do ..	67,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do ..	.002333
Reduction in diameter at point of rupture	do ..	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		.95 from neck
Character of broken surface		fine silky; cup-shaped ends
Elongation of inch sections		"20", "13", ".08

Marks, 49.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3''.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.		
2,000	10,000	.000333	.000200			
4,000	20,000	.000733	.000400			
6,000	30,000	.001067	.000334	0.		
8,000	40,000	.001400	.000333			
10,000	50,000	.001767	.000367	0.		
12,000	60,000	.002100	.000333			
13,000	65,000	.002300	.000200			
14,000	70,000	.002500	.000200			
14,200	71,000	.002567	.000067			Elastic limit.
13,400	67,000	.003467	.000900			Load fell.
13,600	68,000	.006667	.003200			
13,800	69,000	.009667	.003000			
14,000	70,000	.0100	.000333			
14,400	72,000	.0123	.0033			
15,200	76,000	.0167	.0034			
16,000	80,000	.0200	.0033			
16,800	84,000	.0233	.0033			
17,600	88,000	.0267	.0034			
18,400	92,000	.0300	.0033			
19,200	96,000	.0367	.0067			
20,000	100,000	.0433	.0066			
20,800	104,000	.0500	.0067			
21,600	108,000	.0633	.0133			
22,400	112,000	.0867	.0234			
22,660	113,300	.1167	.0300			Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	113,300
Elastic limit per square inch of original section.....	do...	70,000
Elongation per inch after rupture.....	inch...	.1967
Elongation per inch under strain at elastic limit.....	do...	.002500
Reduction in diameter at point of rupture.....	do...	.135
Reduction in area after rupture, per cent of original section.....		46.2
Position of rupture.....		1''.3 from neck
Character of broken surface.....		fine silky
Elongation of inch sections.....	" .27", ".21", ".11	

ROLLED, REHEATED IN GAS FURNACE, AND ANNEALED IN CHARCOAL.

No. 5486.

Marks, 490 B.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000133	.000133	0.	0.		
2,000	10,000	.000233	.000200	.....	.....
4,000	20,000	.000700	.000367	.....	.....
6,000	30,000	.001067	.000367	.....	.....
8,000	40,000	.001433	.000366	.....	.....
10,000	50,000	.001800	.000367	.000033	.000033		
11,800	59,000	.002133	.000333		Elastic limit.
12,000	60,000	.002233	.000100	.....	.....
12,200	61,000	.007167	.004934	.....	.....
12,400	62,000	.007867	.000700	.....	.....
12,600	63,000	.008433	.000566	.....	.....
12,800	64,000	.009000	.000567	.....	.....
13,000	65,000	.009633	.000633	.....	.....
13,600	69,000	.0123	.003667	.....	.....
14,400	72,000	.0167	.0034	.....	.....
15,200	76,000	.0200	.0033	.....	.....
16,000	80,000	.0233	.0033	.....	.....
16,800	84,000	.0267	.0034	.....	.....
17,600	88,000	.0300	.0033	.....	.....
18,400	92,000	.0367	.0067	.....	.....
19,200	96,000	.0433	.0066	.....	.....
20,000	100,000	.0500	.0067	.....	.....
20,800	104,000	.0600	.0100	.....	.....
21,600	108,000	.0800	.0200	.....	.....
21,880	109,400	.1100	.0300	Tensile strength.	

General summary.

Tensile strength per square inch of original section.....	pounds..	109,400
Elastic limit per square inch of original section.....	do..	59,000
Elongation per inch after rupture.....	inch..	.1833
Elongation per inch under strain at elastic limit.....	do..	.002133
Reduction in diameter at point of rupture.....	do..	.085
Reduction in area after rupture, per cent of original section.....		30.7
Position of rupture.....		1".26 from neck
Character of broken surface.....		granular, 60 per cent; silky eccentric spot, 40 per cent
Elongation of inch sections.....		".17, ".23, ".18

No. 5487.

Marks, 490 M.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
200	1,000	0.	0.	0.	0.		
1,000	5,000	.000123	.000123	0.	0.		
2,000	10,000	.000200	.000167	.....	.....
4,000	20,000	.000267	.000267	.....	.....
6,000	30,000	.001023	.000266	.....	.....
8,000	40,000	.001267	.000234	.....	.....
10,000	50,000	.001723	.000266	0.	.....	
12,000	60,000	.002067	.000234	.....	.....
13,000	65,000	.002267	.000200	.....	.....
12,800	64,000	.005667	.002400		Elastic limit. Load fell.
13,000	65,000	.007200	.001523	.....	.....
13,200	66,000	.006667	.001467	.....	.....
14,400	72,000	.0123	.004623	.....	.....
15,200	76,000	.0167	.0034	.....	.....
16,000	80,000	.0200	.0023	.....	.....
16,800	84,000	.0223	.0023	.....	.....
17,600	88,000	.0267	.0024	.....	.....
18,400	92,000	.0300	.0023	.....	.....
19,200	96,000	.0367	.0067	.....	.....
20,000	100,000	.0423	.0066	.....	.....
20,800	104,000	.0500	.0067	.....	.....
21,600	108,000	.0600	.0100	.....	.....
22,400	112,000	.0767	.0167	.....	.....
22,900	114,500	.1233	.0566	Tensile strength.	

General summary.

Tensile strength per square inch of original section.....	pounds..	114,500
Elastic limit per square inch of original section.....	do ..	65,000
Elongation per inch after rupture.....	inch..	.1723
Elongation per inch under strain at elastic limit.....	do ..	.002267
Reduction in diameter at point of rupture.....	do ..	.106
Reduction in area after rupture, per cent of original section.....		37.1
Position of rupture.....	1" .6 from neck	
Character of broken surface.....	fine silky	
Elongation of inch sections.....	" .13, " .23, " .4, 1.0	

ROLLED, REHEATED IN GAS FURNACE, AND ANNEALED IN LIME.

No. 5488.

Marks, 491 B.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....
2,000	10,000	.000333	.000200	.....	.....
4,000	20,000	.000667	.000334	.....	.....
6,000	30,000	.001000	.000336	.....	.....
8,000	40,000	.001337	.000334	.....	.....
10,000	50,000	.001700	.000333	0.	.....
12,000	60,000	.002033	.000333	.....	.....
13,800	69,000	.002333	.000300	.....	.....
14,000	70,000	.002500	.000167	.....	.....
13,200	66,000	.004000	.001500	.....	.....
13,400	67,000	.006333	.002333	.....	.....
13,600	68,000	.008667	.001834	.....	.....
14,000	70,000	.0100	.001333	.....	.....
15,200	76,000	.0133	.0033	.....	.....
16,000	80,000	.0200	.0067	.....	.....
16,800	84,000	.0233	.0033	.....	.....
17,600	88,000	.0267	.0034	.....	.....
18,400	92,000	.0300	.0033	.....	.....
19,200	96,000	.0333	.0033	.....	.....
20,000	100,000	.0400	.0067	.....	.....
20,800	104,000	.0467	.0067	.....	.....
21,600	108,000	.0567	.0100	.....	.....
22,400	112,000	.0700	.0133	.....	.....
23,120	115,600	.1300	.0900	.....	.....
						Tensile strength.

General summary..

Tensile strength per square inch of original section.....	pounds..	115,600
Elastic limit per square inch of original section.....	do...	69,000
Elongation per inch after rupture.....	inch..	.1667
Elongation per inch under strain at elastic limit.....	do...	.002333
Reduction in diameter at point of rupture.....	do...	.115
Reduction in area after rupture, per cent of original section.....	.....	40.3
Position of rupture.....	1".	16 from neck
Character of broken surface.....	.....	fine silky
Elongation of inch sections.....	"24", ".17", ".09	

No. 5489.

Marks, 491 M.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000183	.000133	0.	0.		
2,000	10,000	.000800	.000167	-----	-----		
4,000	20,000	.000667	.000367	-----	-----		
6,000	30,000	.001000	.000333	-----	-----		
8,000	40,000	.001367	.000367	-----	-----		
10,000	50,000	.001733	.000366	0.	-----		
12,000	60,000	.002067	.000334	-----	-----		
13,000	65,000	.002283	.000166	-----	-----		
14,000	70,000	.002400	.000167	0.	-----		
15,000	75,000	.002800	.000200	-----	-----		
14,400	73,000	.006333	.003733	-----	-----		Elastic limit. Load fell.
14,600	73,000	.009000	.002667	-----	-----		
15,200	76,000	.0123	.0043	-----	-----		
16,000	80,000	.0167	.0034	-----	-----		
16,800	84,000	.0200	.0033	-----	-----		
17,600	88,000	.0233	.0033	-----	-----		
18,400	92,000	.0267	.0034	-----	-----		
19,200	96,000	.0300	.0033	-----	-----		
20,000	100,000	.0367	.0067	-----	-----		
20,800	104,000	.0433	.0066	-----	-----		
21,600	108,000	.0500	.0067	-----	-----		
22,400	112,000	.0600	.0100	-----	-----		
23,200	116,000	.0683	.0233	-----	-----		
23,620	118,100	.1267	.0434	-----	-----	Tensile strength.	

General summary.

Tensile strength per square inch of original section..... pounds.. 118,100
 Elastic limit per square inch of original section..... do... 75,000
 Elongation per inch after rupture..... inch... .1800
 Elongation per inch under strain at elastic limit..... do... .002600
 Reduction in diameter at point of rupture..... do... .125
 Reduction in area after rupture, per cent of original section..... 43.3
 Position of rupture..... 1".04 from neck
 Character of broken surface..... fine silky
 Elongation of inch sections..... ".10, ".14, ".30"

ROLLED, REHEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN CHARCOAL.

No. 5490.

Marks, 492 B.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000100	.000100	0.	Elastic limit.
2,000	10,000	.000300	.000200	.....	.....
4,000	20,000	.000677	.000377	.....	.....
6,000	30,000	.001000	.000333	.....	.....
8,000	40,000	.001333	.000333	.....	.....
10,000	50,000	.001677	.000334	.....	.....
12,000	60,000	.002033	.000366	0.	.....
12,200	61,000	.002100	.000067	.....	.....
12,400	62,000	.002300	.000200	.....	.....
12,600	63,000	.002533	.000233	.....	.....
12,800	64,000	.002477	.000084	.....	.....
13,000	65,000	.004500	.001033	.....	.....
13,200	66,000	.005377	.000877	.....	.....
13,400	67,000	.005833	.000566	.....	.....
13,600	68,000	.006300	.000367	.....	.....
13,800	69,000	.006833	.000633	.....	.....
14,000	70,000	.007700	.000767	.....	.....
15,200	76,000	.0133	.0056	.....	.....
16,000	80,000	.0177	.0084	.....	.....
16,800	84,000	.0177+	.0000+	.....	.....
17,600	88,000	.0200	.0083	.....	.....
18,400	92,000	.0233	.0083	.....	.....
19,200	96,000	.0277	.0084	.....	.....
20,000	100,000	.0300	.0083	.....	.....
20,800	104,000	.0333	.0083	.....	.....
21,600	108,000	.0377	.0034	.....	.....
22,400	112,000	.0433	.0066	.....	.....
23,200	116,000	.0500	.0087	.....	.....
24,000	120,000	.0633	.0133	.....	.....
24,800	124,000	.0967	.0334	.....	.....
		.1133	.0166	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	124,000
Elastic limit per square inch of original section.....	do...	61,000
Elongation per inch after rupture.....	inch..	.1100
Elongation per inch under strain at elastic limit.....	do.....	.002100
Reduction in diameter at point of rupture.....	do.....	.045
Reduction in area after rupture, per cent of original section.....		16.9
Position of rupture.....		".7 from neck
Character of broken surface.....		fine granular, radiating from the center
Elongation of inch sections.....		".15", ".10", ".08

No. 5491.

Marks, 492 M.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000167	.000167	0.	Elastic limit.
2,000	10,000	.000300	.000133	.....	.....
4,000	20,000	.000433	.000333	.....	.....
6,000	30,000	.001000	.000367	.....	.....
8,000	40,000	.001367	.000367	.....	.....
10,000	50,000	.001700	.000333	0.	.....
12,000	60,000	.002033	.000333	.....	.....
13,000	65,000	.002233	.000200	.....	.....
13,200	66,000	.002433	.000200	.....	.....
13,400	67,000	.003567	.001134	.....	.....
13,600	68,000	.004833	.001266	.....	.....
13,800	69,000	.006000	.001167	.....	.....
14,000	70,000	.006833	.000633	.....	.....
14,200	71,000	.007433	.000600	.....	.....
14,400	72,000	.007867	.000434	.....	.....
14,600	73,000	.006500	.000633	.....	.....
14,800	74,000	.009133	.000633	.....	.....
15,200	78,000	.0100	.000867	.....	.....
16,000	80,000	.0133	.0033	.....	.....
16,800	84,000	.0167	.0034	.....	.....
17,600	88,000	.0200	.0033	.....	.....
18,400	92,000	.0233	.0033	.....	.....
19,200	96,000	.0267	.0034	.....	.....
20,000	100,000	.0300	.0033	.....	.....
20,800	104,000	.0333	.0033	.....	.....
21,600	108,000	.0367	.0034	.....	.....
22,400	112,000	.0433	.0066	.....	.....
23,200	116,000	.0533	.0100	.....	.....
24,000	120,000	.0667	.0134	.....	.....
24,650	123,250	.1000	.0333	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	123,250
Elastic limit per square inch of original section.....	do...	65,000
Elongation per inch after rupture.....	inch..	.1067
Elongation per inch under strain at elastic limit.....	do...	.002233
Reduction in diameter at point of rupture.....	do...	.055
Reduction in area after rupture, per cent of original section.....		20.5
Position of rupture.....	"	5 from neck
Character of broken surface.....	fine granular, radiating from an eccentric spot	
Elongation of inch sections.....	"	.16, ".09, ".07

ROLLED, REHEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN LIME.

No. 5492.

Marks, 493 B.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3'".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000123	.000123	0.	.....
2,000	10,000	.000200	.000167	0.	.....
4,000	20,000	.000333	.000333	.....	.....
6,000	30,000	.001000	.000367	.....	.....
8,000	40,000	.001833	.000333	.....	.....
10,000	50,000	.001700	.000367	0.	.....
12,000	60,000	.002033	.000333	.....	.....
13,400	67,000	.002200	.000267	.....	.....	Elastic limit.
13,600	68,000	.002667	.000367	.....	.....
13,800	69,000	.002633	.000466	.....	.....
14,000	70,000	.004667	.001234	.....	.....
14,200	71,000	.006600	.000733	.....	.....
14,400	72,000	.006333	.000733	.....	.....
15,200	76,000	.0100	.003667	.....	.....
16,000	80,000	.0132	.0033	.....	.....
16,800	84,000	.0167	.0034	.....	.....
18,400	92,000	.0200	.0033	.....	.....
19,200	96,000	.0233	.0033	.....	.....
20,000	100,000	.0267	.0034	.....	.....
20,800	104,000	.0300	.0033	.....	.....
21,600	108,000	.0333	.0033	.....	.....
22,400	112,000	.0367	.0034	.....	.....
23,200	116,000	.0433	.0066	.....	.....
24,000	120,000	.0500	.0067	.....	.....
24,800	124,000	.0633	.0133	.....	.....
25,460	127,300	.0900	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	127,300
Elastic limit per square inch of original section.....	do...	67,000
Elongation per inch after rupture.....	inch..	.1067
Elongation per inch under strain at elastic limit.....	do...	.002800
Reduction in diameter at point of rupture.....	do...	.065
Reduction in area after rupture, per cent of original section.....		20.5
Position of rupture.....		".56 from neck
Character of broken surface.....	fine granular, radiating from a point near the center	
Elongation of inch sections.....		".07, ".08, ".17"

No. 5493.

Marks, 493 M.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000133	.000133	0.	0.	
2,000	10,000	.000333	.000200	0.	0.	
4,000	20,000	.000700	.000367	0.	0.	
6,000	30,000	.001033	.000333	0.	0.	
8,000	40,000	.001400	.000367	0.	0.	
10,000	50,000	.001733	.000333	0.	0.	
12,000	60,000	.002100	.000367	0.	0.	
13,000	65,000	.002300	.000200	0.	0.	
13,200	66,000	.002433	.000133	0.	0.	
13,400	67,000	.002567	.000434	0.	0.	
13,600	68,000	.004067	.001200	0.	0.	
13,800	69,000	.004667	.006600	0.	0.	
14,000	70,000	.005367	.000700	0.	0.	
14,200	71,000	.005667	.000300	0.	0.	
14,400	72,000	.006033	.000366	0.	0.	
14,600	73,000	.006533	.000500	0.	0.	
14,800	74,000	.007300	.000767	0.	0.	
15,000	75,000	.007333	.000533	0.	0.	
15,200	76,000	.008467	.000634	0.	0.	
16,000	80,000	.0133	.004533	0.	0.	
16,800	84,000	.0187	.0034	0.	0.	
17,600	88,000	.0200	.0033	0.	0.	
19,200	96,000	.0233	.0033	0.	0.	
20,000	100,000	.0267	.0034	0.	0.	
20,800	104,000	.0300	.0033	0.	0.	
21,600	108,000	.0333	.0033	0.	0.	
22,400	112,000	.0400	.0067	0.	0.	
23,200	116,000	.0467	.0067	0.	0.	
24,000	120,000	.0567	.0100	0.	0.	
24,800	124,000	.0700	.0133	0.	0.	
25,180	125,900	.0967	.0267	0.	0.	

General summary.

Tensile strength per square inch of original section.....	pounds..	125,900
Elastic limit per square inch of original section.....	do..	65,000
Elongation per inch after rupture.....	inch..	.1100
Elongation per inch under strain at elastic limit.....	do..	.002300
Reduction in diameter at point of rupture.....	do..	.045
Reduction in area after rupture, per cent of original section.....	do..	16.9
Position of rupture.....	"	.70 from neck
Character of broken surface.....		fine granular, radiating from a dull silky center
Elongation of inch sections.....	"	.17, ".09, ".07

ROLLED, REHEATED IN GAS FURNACE, ANNEALED IN CHARCOAL, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN CHARCOAL.

No. 5494.

Marks, 494 B.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.000133	0.000133	0.	0.	
2,000	5,000	.000333	.000200	.....	.....
4,000	10,000	.000667	.000334	.....	.....
6,000	20,000	.001000	.000333	.....	.....
8,000	30,000	.001333	.000333	.....	.....
10,000	40,000	.001667	.000334	0.	.....
12,000	50,000	.002000	.000333	0.	.....
12,800	64,000	.002133	.000133	.....	.....
13,000	65,000	.002233	.000100	.....	.....
12,800	63,000	.003133	.000900	.....	.....
12,800	64,000	.006167	.003034	.....	.....
13,000	65,000	.008967	.002897	.....	.....
13,200	66,000	.009667	.000700	.....	.....
14,000	70,000	.0133	.003433	.....	.....
15,200	76,000	.0200	.0067	.....	.....
16,000	80,000	.0233	.0033	.....	.....
16,800	84,000	.0267	.0034	.....	.....
17,600	88,000	.0300	.0033	.....	.....
18,400	92,000	.0333	.0033	.....	.....
19,200	96,000	.0400	.0067	.....	.....
20,000	100,000	.0467	.0067	.....	.....
20,800	104,000	.0500	.0100	.....	.....
21,600	108,000	.0667	.0100	.....	.....
22,400	112,000	.1000	.0333	.....	.....
22,450	112,250	.1200	.0200	.....	.....
						Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	112,250
Elastic limit per square inch of original section.....	do..	64,000
Elongation per inch after rupture.....	inch..	.1767
Elongation per inch under strain at elastic limit.....	do..	.002133
Reduction in diameter at point of rupture.....	do..	.095
Reduction in area after rupture, per cent of original section.....		34.0
Position of rupture.....		1".6 from neck
Character of broken surface.....		silky, interspersed with fine granulation
Elongation of inch sections.....		".12, ".27, ".14

No. 5495.

Marks, 494 M.

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
200	1,000	0.	0.	0.	0.		
1,000	5,000	.000167	.000167	0.	-----		
2,000	10,000	.000333	.000166	-----	-----		
4,000	20,000	.000700	.000267	-----	-----		
6,000	30,000	.001067	.000267	-----	-----		
8,000	40,000	.001400	.000333	-----	-----		
10,000	50,000	.001767	.000367	0.	-----		
11,000	55,000	.002000	.000283	-----	-----		
12,000	60,000	.002133	.000133	-----	-----		
13,000	65,000	.002333	.000200	-----	-----		
12,800	64,000	.005133	.002800	-----	-----		Elastic limit. Load fell.
13,000	65,000	.006800	.001667	-----	-----		
13,200	66,000	.009000	.002200	-----	-----		
14,400	72,000	.0133	.0043	-----	-----		
15,200	76,000	.0200	.0067	-----	-----		
16,000	80,000	.0233	.0083	-----	-----		
16,800	84,000	.0267	.0084	-----	-----		
17,600	88,000	.0300	.0083	-----	-----		
18,400	92,000	.0333	.0083	-----	-----		
19,200	96,000	.0367	.0084	-----	-----		
20,000	100,000	.0467	.0100	-----	-----	Tensile strength.	
20,800	104,000	.0533	.0066	-----	-----		
21,600	108,000	.0667	.0134	-----	-----		
22,400	112,000	.1000	.0383	-----	-----		
22,570	112,850	.1167	.0167	-----	-----		

General summary.

Tensile strength per square inch of original section.....pounds.. 112,850
 Elastic limit per square inch of original section.....do... 65,000
 Elongation per inch after rupture.....inch... .1700
 Elongation per inch under strain at elastic limit.....do... .002333
 Reduction in diameter at point of rupture.....do... .005
 Reduction in area after rupture, per cent of original section.....do... 84.0
 Position of rupture.....1".68 from neck
 Character of broken surface.....silky, with a trace of granulation
 Elongation of inch sections.....".12", ".27", ".12

ROLLED, REHEATED IN GAS FURNACE, ANNEALED IN CHARCOAL, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN LIME.

No. 5496.

Marks, 495 B.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000133	.000133	0.	0.		
2,000	10,000	.000300	.000167	.....	.....
4,000	20,000	.000687	.000367	.....	.....
6,000	30,000	.001053	.000366	.....	.....
8,000	40,000	.001400	.000367	.....	.....
10,000	50,000	.001733	.000333	0.	.....	
12,000	60,000	.002100	.000367	.....	.....
13,200	66,000	.002287	.000167	.....	.....
13,400	67,000	.002467	.000200	.....	.....
12,800	64,000	.004100	.001633		Load fell.
13,000	65,000	.007733	.003633	.....	.....
13,200	66,000	.008300	.000567	.....	.....
14,400	72,000	.0133	.0050	.....	.....
15,200	76,000	.0187	.0034	.....	.....
16,000	80,000	.0200	.0033	.....	.....
16,800	84,000	.0233	.0033	.....	.....
17,800	88,000	.0267	.0034	.....	.....
18,400	92,000	.0300	.0033	.....	.....
19,200	96,000	.0333	.0033	.....	.....
20,000	100,000	.0400	.0067	.....	.....
20,800	104,000	.0433	.0033	.....	.....
21,600	108,000	.0500	.0067	.....	.....
22,400	112,000	.0667	.0167	.....	.....
23,200	116,000	.0900	.0233	.....	.....
23,280	116,400	.1067	.0167	Tensile strength.	

General summary.

Tensile strength per square inch of original sectionpounds.. 116,400
 Elastic limit per square inch of original sectiondo... 66,000
 Elongation per inch after rupture.....inch... .1509
 Elongation per inch under strain at elastic limit.....do... .002287
 Reduction in diameter at point of rupture.....do... .085
 Reduction in area after rupture, per cent of original section.....do... 30.7
 Position of rupture....." .95 from neck
 Character of broken surface silky, interspersed with fine granulation
 Elongation of inch sections ".09, ".12, ".24"

No. 5497.

Marks, 495 M.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....
2,000	10,000	.000300	.000167	.....	.....
4,000	20,000	.000667	.000367	.....	.....
6,000	30,000	.001000	.000333	.....	.....
8,000	40,000	.001333	.000333	.....	.....
10,000	50,000	.001667	.000334	0.	.....
12,000	60,000	.002000	.000366	.....	.....
13,000	65,000	.002200	.000167	.....	.....
13,800	69,000	.002367	.000167	.....	.....
13,800	68,000	.002833	.000466	.....	.....
13,800	69,000	.003267	.000434	.....	.....
14,000	70,000	.004300	.001033	.....	.....
14,400	72,000	.005633	.005533	.....	.....
14,400	72,000	.0133	.003467	.....	.....
15,200	76,000	.0167	.0034	.....	.....
16,000	80,000	.0200	.0033	.....	.....
17,600	88,000	.0233	.0033	.....	.....
18,400	92,000	.0267	.0034	.....	.....
19,200	96,000	.0333	.0066	.....	.....
20,000	100,000	.0367	.0034	.....	.....
20,800	104,000	.0433	.0066	.....	.....
21,600	108,000	.0533	.0100	.....	.....
22,400	112,000	.0667	.0134	.....	.....
22,420	112,100	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	112,100
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1167
Elongation per inch under strain at elastic limit	do...	.002367
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture	"	.25 from neck.
Character of broken surface.....	exceedingly fine granular, radiating from a point near the center; cup-shaped ends.	
Elongation of inch sections.....	"	.04, ".05, ".26*

ROLLED, ANNEALED IN CHARCOAL, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN CHARCOAL.

No. 5498.

Marks, 496 B.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000167	.000167	0.	.....
2,000	10,000	.000333	.000166	.....	.....
4,000	20,000	.000667	.000334	.....	.....
6,000	30,000	.001000	.000333	.....	.....
8,000	40,000	.001333	.000333	.....	.....
10,000	50,000	.001700	.000367	0.	.....
11,000	55,000	.001867	.000167	.....	.....
12,000	60,000	.002033	.000166	0.	.....
13,000	65,000	.002267	.000234	.....	.....
18,200	65,000	.004000	.001733	.....	.....
13,400	67,000	.006100	.002100	.....	.....
13,600	68,000	.008167	.002167	.....	.....
14,400	72,000	.0133	.005133	.....	.....
15,200	76,000	.0167	.0034	.....	.....
16,800	84,000	.0200	.0033	.....	.....
17,600	88,000	.0233	.0033	.....	.....
18,400	92,000	.0267	.0034	.....	.....
19,200	96,000	.0300	.0033	.....	.....
20,000	100,000	.0333	.0033	.....	.....
20,800	104,000	.0400	.0067	.....	.....
21,600	108,000	.0467	.0067	.....	.....
22,400	112,000	.0533	.0066	.....	.....
23,200	116,000	.0667	.0134	.....	.....
23,960	119,800	.1133	.0466	.....	.....
						Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	119,800
Elastic limit per square inch of original section.....	do..	65,000
Elongation per inch after rupture.....	inch..	.1500
Elongation per inch under strain at elastic limit.....	do..	.002267
Reduction in diameter at point of rupture.....	do..	.075
Reduction in area after rupture, per cent of original section.....		27.4
Position of rupture.....	"	.9 from neck
Character of broken surface.....		silky and fine granulation interspersed
Elongation of inch sections.....	"	.22", ".13", ".10

No. 5499.

Marks, 496 M.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000123	.000133	0.	0.	
2,000	10,000	.000300	.000167	.....	.....
4,000	20,000	.000667	.000267	.....	.....
6,000	30,000	.001023	.000366	.....	.....
8,000	40,000	.001387	.000324	.....	.....
10,000	50,000	.001700	.000333	0.	.....
12,000	60,000	.002067	.000367	.....	.....
13,000	65,000	.002223	.000166	.....	.....
15,000	68,000	.002367	.000124	.....	.....
15,800	69,000	.003000	.000633	.....	.....
12,800	64,000	.003100	.000100	.....	.....
13,000	65,000	.003267	.000267	.....	.....
13,200	66,000	.004100	.000733	.....	.....
13,400	67,000	.005033	.001333	.....	.....
13,600	68,000	.006167	.002234	.....	.....
14,400	72,000	.0133	.004133	.....	.....
15,200	76,000	.0167	.0034	.....	.....
16,000	80,000	.0200	.0033	.....	.....
17,600	88,000	.0233	.0033	.....	.....
18,400	92,000	.0267	.0034	.....	.....
19,200	96,000	.0300	.0033	.....	.....
20,000	100,000	.0367	.0067	.....	.....
20,800	104,000	.0400	.0033	.....	.....
21,600	108,000	.0467	.0067	.....	.....
22,400	112,000	.0567	.0100	.....	.....
23,200	116,000	.0700	.0133	.....	.....
23,810	119,050	.1133	.0433	.....	.....
						Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	119,050
Elastic limit per square inch of original section.....	do ..	68,000
Elongation per inch after rupture.....	inch..	.1767
Elongation per inch under strain at elastic limit.....	do ..	.002367
Reduction in diameter at point of rupture.....	do ..	.085
Reduction in area after rupture, per cent of original section.....		30.7
Position of rupture.....		1/4 from neck
Character of broken surface.....		silky and fine granulation interspersed
Elongation of inch sections.....		" 13, " 24, " 15

ROLLED, ANNEALED IN CHARCOAL, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN LIME.

No. 5500.

Marks, 497 B.

Diameter, ".505.

Sectional area, .20 square inch

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000167	.000167	0.			
2,000	10,000	.000333	.000166				
4,000	20,000	.000667	.000334				
6,000	30,000	.001033	.000366				
8,000	40,000	.001367	.000334				
10,000	50,000	.001700	.000333	0.			
12,000	60,000	.002067	.000367	.000033	.000033		
12,800	63,000	.002233	.000166				Elastic limit.
12,800	64,000	.002500	.000267				
12,400	62,000	.002833	.000333				Load fell.
12,600	63,000	.003467	.000634				
12,800	64,000	.005033	.001566				
13,000	65,000	.005467	.000484				
13,200	66,000	.006300	.000833				
13,400	67,000	.006600	.000300				
13,600	68,000	.007267	.000667				
13,800	69,000	.007933	.000666				
14,000	70,000	.008600	.000667				
14,400	72,000	.0100	.0014				
15,200	76,000	.0133	.0033				
16,000	80,000	.0167	.0034				
16,800	84,000	.0200	.0033				
17,600	88,000	.0233	.0033				
18,400	92,000	.0267	.0034				
19,200	96,000	.0300	.0033				
20,000	100,000	.0333	.0033				
20,800	104,000	.0367	.0034				
21,600	108,000	.0433	.0066				
22,400	112,000	.0500	.0067				
23,200	116,000	.0633	.0133				
24,000	120,000	.0967	.0334			Tensile strength.	

General summary.

Tensile strength per square inch of original section	..... pounds..	120,000
Elastic limit per square inch of original section	..... do...	63,000
Elongation per inch after rupture	..... inch...	.1333
Elongation per inch under strain at elastic limit	..... do...	.002233
Reduction in diameter at point of rupture	..... do...	.075
Reduction in area after rupture, per cent of original section	.....	27.4
Position of rupture	.....	".9 from neck
Character of broken surface	.....	fine granular dull silky eccentric spot
Elongation of inch sections	.....	".08, ".12, ".20"

No. 5501.

Marks, 497 M.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000133	.000133	0.	Elastic limit.
2,000	10,000	.000333	.000333	.....	.....
4,000	20,000	.000667	.000667	.....	.....
6,000	30,000	.001000	.000833	.....	.....
8,000	40,000	.001367	.000867	.....	.....
10,000	50,000	.001700	.000833	0.	.....
12,000	60,000	.002067	.000867	.....	.....
13,000	65,000	.002267	.000800	.....	.....
13,800	69,000	.002433	.000166	.....	.....
14,000	70,000	.002833	.000400	.....	.....
14,200	71,000	.003933	.001100	.....	.....
14,400	72,000	.005500	.001567	.....	.....
14,600	73,000	.007333	.001233	.....	.....
15,200	76,000	.0100	.003267	.....	.....
16,000	80,000	.0133	.0033	.....	.....
16,800	84,000	.0167	.0034	.....	.....
17,600	88,000	.0200	.0033	.....	.....
18,400	92,000	.0233	.0033	.....	.....
19,200	96,000	.0267	.0034	.....	.....
20,000	100,000	.0300	.0033	.....	.....
20,800	104,000	.0333	.0033	.....	.....
21,600	108,000	.0400	.0067	.....	.....
22,400	112,000	.0433	.0033	.....	.....
23,200	116,000	.0567	.0134	.....	.....
24,000	120,000	.0733	.0166	.....	.....
24,620	123,100	.1133	.0400	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	123,100
Elastic limit per square inch of original section.....	do..	69,000
Elongation per inch after rupture.....	inch..	.1667
Elongation per inch under strain at elastic limit.....	do..	.002433
Reduction in diameter at point of rupture.....	do..	.105
Reduction in area after rupture, per cent of original section.....		37.1
Position of rupture.....		1" from neck
Character of broken surface.....		silky, with trace of granulation
Elongation of inch sections.....		" .36", ".14", ".10

ROLLED, ANNEALED IN AIR, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN CHARCOAL.

No. 5502.

Marks, 498 B.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000167	.000167	0.	0.		
2,000	10,000	.000333	.000166	.....	.....
4,000	20,000	.000700	.000387	.....	.....
6,000	30,000	.001033	.000333	.....	.....
8,000	40,000	.001367	.000334	.....	.....
10,000	50,000	.001733	.000366	000033	000033		
11,000	55,000	.001833	.000200		Elastic limit.
11,200	56,000	.002000	.000067	.....	.....
11,400	57,000	.003267	.001287	.....	.....
11,600	58,000	.003733	.000466	.....	.....
11,800	59,000	.004000	.000287	.....	.....
12,000	60,000	.004667	.000667	.....	.....
12,200	61,000	.005367	.000700	.....	.....
12,400	62,000	.006300	.000933	.....	.....
12,600	63,000	.007000	.000700	.....	.....
12,800	64,000	.007500	.000500	.....	.....
13,000	68,000	.0100	.0025	.....	.....
14,400	72,000	.0133	.0033	.....	.....
15,200	76,000	.0167	.0034	.....	.....
16,000	80,000	.0200	.0033	.....	.....
16,800	84,000	.0233	.0033	.....	.....
17,600	88,000	.0267	.0034	.....	.....
18,400	92,000	.0300	.0033	.....	.....
19,200	96,000	.0333	.0033	.....	.....
20,000	100,000	.0400	.0067	.....	.....
20,800	104,000	.0467	.0067	.....	.....
21,600	108,000	.0567	.0100	.....	.....
22,400	112,000	.0733	.0166	.....	.....
22,820	114,100	.1100	.0387	Tensile strength.	

General summary.

Tensile strength per square inch of original section.....pounds.. 114,000
 Elastic limit per square inch of original section.....do... 56,000
 Elongation per inch after rupture.....inch... .1533
 Elongation per inch under strain at elastic limit.....do... .002000
 Reduction in diameter at point of rupture.....do... .075
 Reduction in area after rupture, per cent of original section.....do... 27.4
 Position of rupture.....1 1/1 from neck
 Character of broken surface..... granular, irregular surface; dull spot at the circumference
 Elongation of inch sections..... " .21", ".14", ".11

No. 5503.

Marks, 498 M.
 Diameter; ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000133	.000133	0.	0.		
2,000	10,000	.000300	.000167	.....	.....
4,000	20,000	.000667	.000367	.....	.....
6,000	30,000	.001033	.000366	.....	.....
8,000	40,000	.001367	.000334	.....	.....
10,000	50,000	.001733	.000366	.000033	.000033		
11,000	55,000	.001900	.000167	.....	.....
11,800	59,000	.002067	.000167	.....	.....
12,000	60,000	.002133	.000066	.000067	.000034		Elastic limit.
12,200	61,000	.002267	.000234	.....	.....
12,400	62,000	.002367	.000600	.....	.....
12,600	63,000	.004967	.002000	.....	.....
12,800	64,000	.005500	.000533	.....	.....
13,000	65,000	.006233	.000733	.....	.....
13,200	66,000	.006700	.000467	.....	.....
13,400	67,000	.007167	.000467	.....	.....
13,600	68,000	.007800	.000633	.....	.....
14,000	72,000	.008633	.000833	.....	.....
15,200	76,000	.0133	.004667	.....	.....
16,800	84,000	.0167	.0034	.....	.....
17,600	88,000	.0200	.0033	.....	.....
18,400	92,000	.0233	.0033	.....	.....
19,200	96,000	.0267	.0034	.....	.....
20,000	100,000	.0300	.0033	.....	.....
20,800	104,000	.0333	.0083	.....	.....
21,600	108,000	.0400	.0067	.....	.....
22,400	112,000	.0467	.0067	.....	.....
23,200	116,000	.0567	.0100	.....	.....
23,200	116,000	.0733	.0166	.....	.....
23,640	118,200	.1133	.0400	Tensile strength.	

General summary.

Tensile strength per square inch of original section..... pounds.. 118,200
 Elastic limit per square inch of original section..... do... 60,000
 Elongation per inch after rupture..... inch... 1400
 Elongation per inch under strain at elastic limit..... do... 002133
 Reduction in diameter at point of rupture..... do... .085
 Reduction in area after rupture, per cent of original section..... 30.7
 Position of rupture..... ".9 from neck
 Character of broken surface..... fine granular, dull center
 Elongation of inch sections..... ".06, ".11, ".23"

ROLLED, ANNEALED IN AIR, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN LIME.

No. 5504.

Marks, 499 B.
 Diameter ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....
2,000	10,000	.000333	.000200	.....	.....
4,000	20,000	.000667	.000334	.....	.....
6,000	30,000	.001000	.000333	.....	.....
8,000	40,000	.001367	.000367	.....	.....
10,000	50,000	.001700	.000333	0.	.....
11,000	55,000	.001867	.000187	.....	.....
12,000	60,000	.002333	.000186	.....	.....
12,600	63,000	.002133	.000100	.....	.....	Elastic limit.
12,800	64,000	.002367	.000234	.....	.....
13,000	65,000	.003367	.001000	.....	.....
13,200	66,000	.006767	.003400	.....	.....
13,400	67,000	.007267	.000500	.....	.....
13,600	68,000	.008100	.000833	.....	.....
14,400	72,000	.0133	.0052	.....	.....
15,200	76,000	.0167	.0034	.....	.....
16,800	84,000	.0200	.0033	.....	.....
17,600	88,000	.0233	.0033	.....	.....
18,400	92,000	.0267	.0024	.....	.....
19,200	96,000	.0333	.0066	.....	.....
20,000	100,000	.0367	.0034	.....	.....
20,800	104,000	.0433	.0066	.....	.....
21,600	108,000	.0533	.0100	.....	.....
22,400	112,000	.0667	.0134	.....	.....
23,100	115,500	.1033	.0366	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original sectionpounds.. 115,500
 Elastic limit per square inch of original section.....do... 63,000
 Elongation per inch after rupture.....inch... .1367
 Elongation per inch under strain at elastic limit.....do... .002133
 Reduction in diameter at point of rupture.....do... .085
 Reduction in area after rupture, per cent of original section.....do... 30.7
 Position of rupture.....".7 from neck
 Character of broken surface.....fine granular, 60 per cent; silky, 40 per cent
 Elongation of inch sections.....".28", ".10", ".08

No. 5505. !

Marks, 499 M.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000187	.000187	0.			
2,000	10,000	.000367	.000200				
4,000	20,000	.000700	.000333				
6,000	30,000	.001033	.000333				
8,000	40,000	.001400	.000367				
10,000	50,000	.001733	.000333	0.			
11,000	55,000	.001900	.000107				
12,000	60,000	.002100	.000200				
14,000	70,000	.002467	.000367				
14,200	71,000	.002533	.000066				
18,000	68,000	.003333	.000800				Elastic limit. Load fell.
18,800	69,000	.004467	.001134				
14,000	70,000	.006167	.001700				
14,200	71,000	.008000	.001833				
14,400	72,000	.011000	.003000				
15,200	76,000	.0133	.0023				
16,000	80,000	.0167	.0034				
16,800	84,000	.0200	.0033				
17,000	88,000	.0233	.0033				
18,400	92,000	.0267	.0034				
19,200	96,000	.0333	.0066				
20,000	100,000	.0400	.0067				
20,800	104,000	.0467	.0067				
21,600	108,000	.0567	.0100				
22,400	112,000	.0700	.0133				
23,050	115,250	.1167	.0467			Tensile strength.	

General summary.

Tensile strength per square inch of original section	pounds..	115,250
Elastic limit per square inch of original section	do..	71,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do..	.002533
Reduction in diameter at point of rupture	do..	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1.1/2 from neck
Character of broken surface	fine, silky; cup-shaped ends	
Elongation of inch sections	"10, "17, "25"	

REGULAR STOCK, RECENT MANUFACTURE.

No. 5510.

Marks, 49.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000133	.000133	0.			
2,500	10,000	.000367	.000234				
5,000	20,000	.000733	.000366				
7,500	30,000	.001067	.000334				
10,000	40,000	.001400	.000333	0.			
12,500	50,000	.001733	.000333				
15,000	60,000	.002100	.000367	.000033	.000033		
16,000	64,000	.002233	.000133				Elastic limit.
16,250	65,000	.003367	.001134				
15,000	60,000	.008167	.002800			Load fell.	
15,250	61,000	.008667	.002500				
15,500	62,000	.006333	.000666				
16,000	64,000	.0100	.000667				
16,500	66,000	.0133	.0033				
17,000	68,000	.0167	.0034				
18,000	72,000	.0200	.0033				
19,000	76,000	.0233	.0033				
20,000	80,000	.0267	.0034				
20,500	82,000	.0300	.0033				
21,500	86,000	.0333	.0033				
22,000	88,000	.0367	.0034				
22,500	90,000	.0400	.0033				
23,000	92,000	.0433	.0033				
23,500	94,000	.0500	.0067				
24,000	96,000	.0533	.0033				
24,500	98,000	.0600	.0067				
25,000	100,000	.0667	.0067				
25,500	102,000	.0800	.0133				
26,000	104,000	.1067	.0267				
26,180	104,720	.1333	.0266			Tensile strength.	

General summary.

Tensile strength per square inch of original section.....pounds.. 104,720
 Elastic limit per square inch of original section..... do... 64,000
 Elongation per inch after rupture..... inch... .2233
 Elongation per inch under strain at elastic limit.....do... .002233
 Reduction in diameter at point of rupture.....do... .144
 Reduction in area after rupture, per cent of original section.....do... 44.6
 Position of rupture..... at middle of stem
 Character of broken surface..... silky; cup-shaped ends
 Elongation of inch sections.....".15, ".88", ".14

SAME AS SPECIMEN NO. 5510.

No. 5511.

Marks, 49.

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.		
2,000	10,000	.000300	.000187			
4,000	20,000	.000667	.000367			
6,000	30,000	.001033	.000366			
8,000	40,000	.001400	.000367			
10,000	50,000	.001733	.000333	0.		
12,000	60,000	.002100	.000367	.000033	.000033	
12,200	61,000	.002133	.000033			
12,400	62,000	.002167	.000034			
12,600	63,000	.002233	.000066			
12,800	64,000					
12,200	61,000	.005167	.002234				Elastic limit momentarily reached, then load fell.
12,400	62,000	.008333	.003166			
12,800	64,000	.0133	.004967			
13,600	68,000	.0167	.0034			
14,400	72,000	.0200	.0033			
15,200	76,000	.0233	.0033			
16,000	80,000	.0267	.0034			
16,800	84,000	.0300	.0033			
17,600	88,000	.0367	.0067			
18,400	92,000	.0433	.0066			
19,200	96,000	.0533	.0100			
20,000	100,000	.0700	.0187			
20,800	104,000	.0967	.0267			
20,980	104,900	.1400	.0433			Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	104,900
Elastic limit per square inch of original section.....	do..	63,000
Elongation per inch after rupture.....	inch..	2100
Elongation per inch under strain at elastic limit.....	do..	.002233
Reduction in diameter at point of rupture.....	do..	.135
Reduction in area after rupture, per cent of original section.....		46.2
Position of rupture.....	at middle of stem	
Character of broken surface.....	silky	
Elongation of inch sections.....	" 14, " 36, " 13	

STOCK HEATED AND ROLLED TO BARREL, AND ANNEALED (COOLED) IN AIR.

No. 5512.

Marks, 49 A.

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000133	.000133	0.	.....
2,000	10,000	.000333	.000200	.....	.....
4,000	20,000	.000667	.000334	.....	.....
6,000	30,000	.001000	.000333	.....	.....
8,000	40,000	.001333	.000333	.....	.....
10,000	50,000	.001700	.000367	0.	.....
11,000	55,000	.001867	.000167	.....	.....
12,000	60,000	.002033	.000166	0.	.....
12,800	64,000	.002167	.000134	.....	.....
13,000	65,000	.002200	.000033	.....	.....
13,200	66,000	.002267	.000067	.....	.....
13,400	67,000	.002300	.000033	.....	.....
13,600	68,000	.002333	.000033	.....	.....
13,800	69,000	.002367	.000034	.....	.....
14,000	70,000	.002400	.000033	.....	.....
14,200	71,000	.002433	.000033	.....	.....
14,400	72,000	.002467	.000034	.....	.....
14,600	73,000	.002500	.000033	.....	.....
14,800	74,000	.002533	.000033	.....	.....
15,000	75,000	.002600	.000067	.....	.....
16,000	80,000	.002767	.000167	.....	.....
15,000	75,000	.010000	.007233	Elastic limit. Load fell.
15,200	76,000	.0167	.0067	.....	.....
16,000	80,000	.0200	.0033	.....	.....
16,800	84,000	.0233	.0033	.....	.....
17,600	88,000	.0267	.0034	.....	.....
18,400	92,000	.0300	.0033	.....	.....
19,200	96,000	.0333	.0033	.....	.....
20,000	100,000	.0400	.0067	.....	.....
20,800	104,000	.0467	.0067	.....	.....
21,600	108,000	.0567	.0100	.....	.....
22,400	112,000	.0700	.0133	.....	.....
23,200	116,000	.1067	.0367	Tensile strength.
23,240	116,200	.1400	.0333	.....	.....

General summary.

Tensile strength per square inch of original section.....	pounds..	116,200
Elastic limit per square inch of original section.....	do....	80,000
Elongation per inch after rupture.....	inch....	.1887
Elongation per inch under strain at elastic limit.....	do....	.002767
Reduction in diameter at point of rupture.....	do....	.135
Reduction in area after rupture, per cent of original section.....	.....	46.2
Position of rupture.....	.....	".05 from neck
Character of broken surface.....	.....	silky; cup-shaped ends
Elongation of inch sections.....	.....	".11, ".12, ".33"

DUPLICATE OF No. 5512.

No. 5513.

Marks, 49 A.
 Diameter, ".505.
 Sectional area, .20 square inch
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.		
2,000	10,000	.000333	.000200			
4,000	20,000	.000667	.000334			
6,000	30,000	.001000	.000333			
8,000	40,000	.001367	.000367			
10,000	50,000	.001700	.000333	0.		
12,000	60,000	.002067	.000367			
14,000	70,000	.002433	.000366			
14,200	71,000	.002467	.000334			
14,400	72,000	.002533	.000366			
14,600	73,000	.002567	.000334			
14,800	74,000	.002600	.000333			
15,000	75,000	.002633	.000333			
15,200	76,000	.002667	.000334			
15,400	77,000	.002700	.000333			
15,600	78,000	.002733	.000333			
15,800	79,000	.002767	.000334			
16,000	80,000	.002800	.000333			
16,200	81,000	.002833	.000333			
16,400	82,000	.002867	.000334			
16,600	83,000	.002900	.000333			
15,400	77,000	.006133	.003233			Elastic limit. Load fell.
15,600	78,000	.0133	.007167			
16,800	84,000	.0167	.0034			
17,600	88,000	.0200	.0033			
18,400	92,000	.0233	.0033			
19,200	96,000	.0267	.0034			
20,000	100,000	.0300	.0033			
20,800	104,000	.0333	.0033			
21,600	108,000	.0400	.0067			
22,400	112,000	.0467	.0067			
23,200	116,000	.0533	.0066			
24,000	120,000	.0667	.0134			
24,670	123,350	.1067	.0400			Tensile strength.

General summary.

Tensile strength per square inch of original section	..... pounds	123,350
Elastic limit per square inch of original section	..... do	83,000
Elongation per inch after rupture	..... inch	.1787
Elongation per inch under strain at elastic limit	..... do	.002900
Reduction in diameter at point of rupture	..... do	.135
Reduction in area after rupture, per cent of original section	.....	46.2
Position of rupture	.....	1" from neck
Character of broken surface	.....	silky; cup-shaped ends
Elongation of inch sections	.....	".11, ".13, ".29"

STOCK HEATED, ROLLED TO BARREL, AND ANNEALED IN LIME.

No. 5514.

Marks, 49 L.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000183	.000183	.....	.....
2,000	10,000	.000333	.000200	.....	.....
4,000	20,000	.000667	.000334	.....	.....
6,000	30,000	.001000	.000333	.....	.....
8,000	40,000	.001367	.000367	.....	.....
10,000	50,000	.001400	.000333	0.	.....
12,000	60,000	.002067	.000667	.....	.....
14,000	70,000	.002467	.000400	.....	.....
14,800	74,000	.002600	.000183	.....	.....
13,400	67,000	.008000	.005400	.....	.....
13,600	68,000	.010667	.002667	.....	.....
14,000	70,000	.0133	.002633	.....	.....
15,200	78,000	.0167	.0034	.....	.....
16,000	80,000	.0200	.0033	.....	.....
16,800	84,000	.0233	.0033	.....	.....
17,000	88,000	.0267	.0034	.....	.....
18,400	92,000	.0333	.0066	.....	.....
19,200	96,000	.0367	.0034	.....	.....
20,000	100,000	.0433	.0066	.....	.....
20,800	104,000	.0533	.0100	.....	.....
21,000	108,000	.0633	.0100	.....	.....
22,400	112,000	.1000	.0367	.....	.....
22,410	112,050	.1233	.0233	.....	.....
						Elastic limit. Load fell.
						Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	112,050
Elastic limit per square inch of original section.....	do...	74,000
Elongation per inch after rupture	inch...	.2033
Elongation per inch under strain at elastic limit.....	do...	.002800
Reduction in diameter at point of rupture.....	do...	.155
Reduction in area after rupture, per cent of original section.....		51.9
Position of rupture.....		1".87 from neck
Character of broken surface.....		silky; cup-shaped ends
Elongation of inch sections		".12, ".35, ".14

DUPLICATE OF No. 5514.

No. 5515.

Marks, 49 L.

Diameter, ".505.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.		
2,000	10,000	.000333	.000200			
4,000	20,000	.000700	.000367			
6,000	30,000	.001067	.000367			
8,000	40,000	.001433	.000366			
10,000	50,000	.001767	.000334	0.		
12,000	60,000	.002133	.000366			
14,000	70,000	.002533	.000400			
12,800	64,000	.006133	.003600			Elastic limit. Load fell.
13,000	65,000	.006667	.000534			
13,200	66,000	.009667	.003000			
14,000	70,000	.0183	.003633			
15,200	76,000	.0167	.0034			
16,000	80,000	.0200	.0033			
16,800	84,000	.0233	.0033			
17,600	88,000	.0267	.0034			
18,400	92,000	.0300	.0033			
19,200	96,000	.0367	.0067			
20,000	100,000	.0433	.0066			
20,800	104,000	.0500	.0067			
21,600	108,000	.0633	.0133			
22,400	112,000	.0867	.0234			
22,640	113,320	.1267	.0400			Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	113,320
Elastic limit per square inch of original section.....	do....	70,000
Elongation per inch after rupture.....	inch..	.1867
Elongation per inch under strain at elastic limit.....	do....	.002533
Reduction in diameter at point of rupture.....	do....	.125
Reduction in area after rupture, per cent of original section.....		43.3
Position of rupture.....		1.29 from neck
Character of broken surface.....	silky; cup-shaped ends	
Elongation of inch sections.....		.26", .19", .11

STOCK HEATED AND ROLLED TO BARREL AND ANNEALED IN SAND.

No. 5516.

Marks, 49 S.

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000133	.000133	0.	0.		
2,000	10,000	.000333	.000200				
4,000	20,000	.000667	.000334				
6,000	30,000	.001000	.000333				
8,000	40,000	.001367	.000367				
10,000	50,000	.001700	.000333	0.			
12,000	60,000	.002100	.000400				
14,000	70,000	.002500	.000400				
18,000	65,000	.006333	.003633				Elastic limit. Load fell.
18,200	66,000	.009333	.003000				
18,600	68,000	.0133	.003967				
14,400	72,000	.0167	.0034				
16,000	80,000	.0200	.0033				
16,800	84,000	.0233	.0033				
17,600	88,000	.0267	.0034				
18,400	92,000	.0333	.0066				
19,200	96,000	.0400	.0067				
20,000	100,000	.0467	.0067				
20,800	104,000	.0567	.0100			Tensile strength.	
21,600	108,000	.0733	.0166				
22,180	110,900	.1133	.0400				

General summary.

Tensile strength per square inch of original section	pounds..	110,900
Elastic limit per square inch of original section	do ..	70,000
Elongation per inch after rupture	inch ..	.1967
Elongation per inch under strain at elastic limit	do ..	.002500
Reduction in diameter at point of rupture	do ..	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1".6 from neck
Character of broken surface		silky; cup shaped ends
Elongation of inch sections		".16, ".32", ".11

DUPLICATE OF No. 5516.

No. 5517.

Marks, 49 S:

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000133	.000133	0.	0.		
2,000	10,000	.000333	.000200	.....	.....
4,000	20,000	.000667	.000334	.....	.....
6,000	30,000	.001033	.000366	.....	.....
8,000	40,000	.001400	.000367	.....	.....
10,000	50,000	.001733	.000333	0.	.....	
12,000	60,000	.002133	.000400	.....	.....
14,000	70,000	.002500	.000367	.000067	.000067		Elastic limit. Application of load after determining set.
14,000	70,000	.002767	.002767	.....	.....
14,400	72,000	.0100	.001233	.....	.....
14,800	74,000	.0133	.0033	.....	.....
16,000	80,000	.0167	.0034	.....	.....
16,800	84,000	.0200	.0033	.....	.....
17,600	88,000	.0233	.0033	.....	.....
18,400	92,000	.0267	.0034	.....	.....
19,200	96,000	.0300	.0033	.....	.....
20,000	100,000	.0333	.0033	.....	.....
20,800	104,000	.0367	.0034	.....	.....
21,600	108,000	.0467	.0100	.....	.....
22,400	112,000	.0567	.0100	.....	.....
23,200	116,000	.0733	.0166	.....	.....
23,680	118,150	.1133	.0400	Tensile strength.	

General summary.

Tensile strength per square inch of original section	pounds..	118,150
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.002500
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		at middle of stem
Character of broken surface		silky; cup-shaped ends
Elongation of inch sections		".12, ".30", ".12

REGULAR STOCK ROLLED IN BAR 1".1 DIAMETER, FROM WHICH BARRELS WERE MADE WITHOUT HEATING.

No. 5518.

Marks, 57.

Diameter, ".564.

Sectional area, .25 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	0.	
2,500	10,000	.000367	.000234	.....	.....
5,000	20,000	.000783	.000366	.....	.....
7,500	30,000	.001100	.000367	.....	.....
10,000	40,000	.001433	.000383	0.	.....
12,500	50,000	.001800	.000367	.....	.....
15,000	60,000	.002187	.000367	0.	.....
16,250	65,000	.002300	.000133	.....	.....
17,500	70,000	.002500	.000200	0.	.....
17,750	71,000	.002533	.000033	.....	.....
18,000	72,000	.002567	.000034	.....	.....
18,250	73,000	.002600	.000033	.....	.....
18,500	74,000	.002633	.000033	.....	.....
18,750	75,000	.002667	.000034	.....	.....
19,000	76,000	.002700	.000033	.....	.....
19,250	77,000	.002767	.000067	.....	.....	Elastic limit. Load fell.
18,000	72,000	.005233	.002466	.....	.....
18,250	73,000	.006167	.000934	.....	.....
18,500	74,000	.008000	.001833	.....	.....
18,750	75,000	.008533	.000533	.....	.....
19,000	76,000	.009000	.000467	.....	.....
19,500	78,000	.0133	.0043	.....	.....
21,000	84,000	.0167	.0084	.....	.....
22,000	88,000	.0200	.0033	.....	.....
24,000	96,000	.0233	.0033	.....	.....
25,000	100,000	.0267	.0034	.....	.....
26,000	104,000	.0333	.0066	.....	.....
27,000	108,000	.0367	.0084	.....	.....
28,000	112,000	.0433	.0066	.....	.....
29,000	116,000	.0500	.0067	.....	.....
30,000	120,000	.0600	.0100	.....	.....
31,000	124,000	.0833	.0233	.....	.....
31,240	124,960	.1100	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	124,960
Elastic limit per square inch of original section	do.....	77,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do.....	.002767
Reduction in diameter at point of rupture	do.....	.144
Reduction in area after rupture .....	.....	44.6
Position of rupture .....	.....	1".4 from neck
Character of broken surface .....	.....	silky; cup-shaped end
Elongation of inch sections .....	.....	".10, ".31", ".14

ANNEALED IN CHARCOAL AFTER ROLLING.

No. 5531.

Marks, 49 B.

Diameter, ".505.

Sectional area, .20 square inch.

Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
200	1,000	0.	0.	0.	0.	Initial load.	
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....
4,000	20,000	.000633	.000333	.....	.....
6,000	30,000	.001000	.000367	.....	.....
8,000	40,000	.001333	.000333	.....	.....
10,000	50,000	.001667	.000384	0.	.....	
12,000	60,000	.002000	.000333	.....	.....
13,400	67,000	.002300	.000300	.....	.....
12,400	62,000	.004000	.001700		Elastic limit. Load fell.
12,600	63,000	.004500	.000500	.....	.....
12,800	64,000	.008000	.003500	.....	.....
13,000	65,000	.0133	.0053	.....	.....
14,000	70,000	.0167	.0084	.....	.....
15,200	76,000	.0200	.0033	.....	.....
15,600	78,000	.0233	.0033	.....	.....
16,400	82,000	.0267	.0034	.....	.....
17,200	86,000	.0300	.0033	.....	.....
17,600	88,000	.0333	.0033	.....	.....
18,400	92,000	.0367	.0034	.....	.....
18,800	94,000	.0400	.0033	.....	.....
19,200	96,000	.0432	.0033	.....	.....
19,600	98,000	.0467	.0034	.....	.....
20,000	100,000	.0533	.0066	.....	.....
20,400	102,000	.0567	.0034	.....	.....
20,800	104,000	.0633	.0066	.....	.....
21,200	106,000	.0700	.0067	.....	.....
21,600	108,000	.0800	.0100	.....	.....
22,000	110,000	.1132	.0333	.....	.....
22,010	110,050	.1267	.0134	Tensile strength.	

General summary.

Tensile strength per square inch of original section.....	pounds ..	110.050
Elastic limit per square inch of original section.....	do ..	67,000
Elongation per inch after rupture.....	inch ..	.1900
Elongation per inch under strain at elastic limit.....	do ..	.002300
Reduction in diameter at point of rupture.....	do ..	.095
Reduction in area after rupture, per cent of original section.....		34.0
Position of rupture.....		1".5 from neck
Character of broken surface.....		silky, interspersed with fine granulation
Elongation of inch sections.....		".17, ".26, ".12

ANNEALED IN CHARCOAL AFTER ROLLING.

No. 5532.

Marks, 49 M.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3'.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000133	.000133	0.	0.	
2,000	10,000	.000300	.000187	.....	.....
4,000	20,000	.000687	.000387	.....	.....
6,000	30,000	.001033	.000386	.....	.....
8,000	40,000	.001387	.000334	.....	.....
10,000	50,000	.001700	.000333	0.	.....
12,000	60,000	.002033	.000333	.....	.....
13,800	68,000	.002333	.000300	.....	.....
13,200	68,000	.002333	.001000	.....	.....
13,400	67,000	.003500	.000187	.....	.....
13,600	68,000	.004487	.000987	.....	.....
13,800	69,000	.005233	.001766	.....	.....
14,000	70,000	.006887	.000634	.....	.....
14,200	71,000	.007887	.001000	.....	.....
14,400	72,000	.008500	.000633	.....	.....
14,600	73,000	.008887	.000387	.....	.....
14,800	74,000	.009333	.000466	.....	.....
15,200	78,000	.0133	.003987	.....	.....
16,000	80,000	.0187	.0034	.....	.....
17,200	86,000	.0200	.0033	.....	.....
18,000	90,000	.0233	.0033	.....	.....
18,800	84,000	.0267	.0034	.....	.....
19,600	98,000	.0300	.0033	.....	.....
20,400	102,000	.0333	.0033	.....	.....
21,200	106,000	.0367	.0034	.....	.....
21,600	106,000	.0400	.0033	.....	.....
22,000	110,000	.0433	.0033	.....	.....
22,400	112,000	.0467	.0034	.....	.....
22,800	114,000	.0500	.0033	.....	.....
23,200	116,000	.0567	.0067	.....	.....
23,600	118,000	.0633	.0066	.....	.....
24,000	120,000	.0733	.0100	.....	.....
24,400	122,000	.0867	.0134	.....	.....
24,480	122,400	.1133	.0266	.....	.....
						Elastic limit. Load fell.
						Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	122,400
Elastic limit per square inch of original section.....	do.....	69,000
Elongation per inch after rupture.....	inch.....	.1433
Elongation per inch under strain at elastic limit.....	do.....	.002333
Reduction in diameter at point of rupture.....	do.....	.035
Reduction in area after rupture, per cent of original section.....	.....	20.5
Position of rupture.....	.....	1" .5 from neck
Character of broken surface.....	fine granular, radiating from an eccentric spot	
Elongation of inch sections.....	"14, "19", "10	

TABULATION OF TENSION SPECIMENS FROM RIFLE-BARREL STEEL SUBJECTED TO SPECIAL TREATMENT AFTER ROLLING
(LENGTH OF STEMS 3').

No. of test.	Marks.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 3 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.	Treatment.
5484	49.....	.564	Sq. in. .25	Pounds. 67,000	Pounds. 120,560	Per ct. 16.7	Per ct. 44.6	Fine silky; cup shaped.	" "	" "
5485	49.....	.564	.25	70,000	113,300	19.7	40.2	Fine silky	.29*, 13, .08	Rolled, reheated in gas furnace, and annealed in charcoal.
5486	490 B.....	.505	.20	59,000	109,400	19.3	30.7	Granular 60 per cent; silky eccentric spot, 40 per cent.	.27*, 21, .11 .17, 23*, 18	Do.
5487	490 M.....	.505	.20	65,000	114,500	17.3	37.1	Fine silky	.13, 29*, 10	Rolled, reheated in gas furnace, and annealed in lime.
5488	491 B.....	.505	.20	69,000	115,600	16.7	40.3	.....do	.24*, 17, .09	Do.
5489	491 M.....	.505	.20	75,000	118,100	18.0	43.3	.....do	.10, 14, .30*	Rolled, reheated in open coke fire to light cherry color, and annealed in charcoal.
5490	492 B.....	.505	.20	61,000	124,000	11.0	16.9	Fine granular, radiating from the center.	.15*, 10, .08	Do.
5491	492 M.....	.505	.20	65,000	123,250	10.7	20.5	Fine granular, radiating from ar. eccentric spot.	.16*, .09, .07	Do.
5492	493 B.....	.505	.20	67,000	127,300	10.7	20.5	Fine granular, radiating from a point near the center.	.07, .08, .17*	Rolled, reheated in open coke fire to light cherry color, and annealed in lime.
5493	493 M.....	.505	.20	65,000	125,900	11.0	16.9	Fine granular, radiating from a dull silky center.	.17*, .09, .07	Do.
5494	494 B.....	.505	.20	64,000	112,250	17.7	34.0	Silky, interspersed with fine granulation.	.12, .27*, 14	Rolled, reheated in gas furnace, annealed in charcoal, reheated in open coke fire to light cherry color, and annealed in charcoal.
5495	494 M.....	.505	.20	65,000	112,850	17.0	34.0	Silky, with trace of granulation.	.12, 27*, 12	Do.
5496	495 B.....	.505	.20	65,000	116,400	15.0	30.7	Silky, interspersed with fine granulation.	.09, .12, .24*	Rolled, reheated in gas furnace, annealed in charcoal, reheated in open coke fire to light cherry color, and annealed in lime.
5497	495 M.....	.505	.20	69,000	112,100	11.7	43.3	Exceedingly fine granular, radiating from a point near center; cup shaped.	.04, .05, .26*	Do.
5498	496 B.....	.505	.20	65,000	119,800	15.0	27.4	Silky, and fine granulation interspersed.	.23*, 13, .10	Rolled, annealed in charcoal, heated in open coke fire to light cherry color, and annealed in charcoal.
5499	496 M.....	.505	.20	68,000	119,050	17.7	30.7	.....do	.13, 24*, 16	Do.
5500	497 B.....	.505	.20	63,000	120,000	13.3	27.4	Fine granular; dull silky eccentric spot.	.08, .12, .20*	Rolled, annealed in charcoal, heated in open coke fire to light cherry color, and annealed in lime.
5501	497 M.....	.505	.20	69,000	123,100	16.7	37.1	Silky, with trace of granulation.	.26*, 14, .10	Do.

5502	498 B	.505	.20	56,000	114,100	15.3	27.4	Granular, irregular surface; dull spot at the circumference.	.21*, .14, .11	Rolled, annealed in air, heated in open coke fire to light cherry color, and annealed in charcoal.
5503	498 M	.505	.20	60,000	118,200	14.0	30.7	Fine granular; dull center.	.08, .11, .23*	Do.
5504	499 B	.505	.20	63,000	115,500	13.7	30.7	Fine granular; 60 per cent; silky, 40 per cent.	.23*, .10, .08	Rolled, annealed in air, heated in open coke fire to light cherry color, and annealed in lime.
5505	499 M	.505	.20	71,000	115,250	17.3	37.1	Fine silky; cup shaped	.10, .17, .25*	Do.
5510	49	.564	.25	64,000	104,720	22.3	44.6	Silky; cup shaped.	.15, .38*, .14	Regular stock; recent manufacture.
5511	49	.505	.20	63,000	104,900	21.0	46.2	Silky; cup shaped.	.14, .36*, .13	Do.
5512	49 A	.505	.20	80,000	116,200	18.7	46.2	Silky; cup shaped.	.11, .12, .33*	Stock heated and rolled to barrel and annealed (cooled) in air.
5513	49 A	.505	.20	83,000	123,350	17.7	46.2	do	.11, .13, .29*	Do.
5514	49 L	.505	.20	74,000	112,060	20.3	51.9	do	.12, .35*, .14	Stock heated, rolled to barrel, and annealed in lime.
5515	49 I	.505	.20	70,000	113,320	18.7	43.3	do	.26*, .19, .11	Do.
5516	49 S	.505	.20	70,000	110,900	19.7	43.3	do	.16, .32*, .11	Stock heated and rolled to barrel and annealed in sand.
5517	49 S	.505	.20	70,000	118,150	18.0	40.3	do	.12, .30*, .12	Do.
5518	57	.564	.25	77,000	124,900	18.3	44.6	do	.10, .31*, .14	Regular stock rolled in bar 1.1 inch diameter, from which barrels were made without heating.
5531	49 B	.505	.20	67,000	110,050	19.0	34.0	Silky, interspersed with fine granulation.	.17, .28*, .12	Annealed in charcoal after rolling.
5532	49 B	.505	.20	69,000	122,400	14.8	20.5	Face granular, radiating from an eccentric spot.	.14, .19*, .10	Do.

HARDNESS OF RIFLE BARRELS, CAL. .30.

The relative hardness of four half rifle barrels was determined at different places along their lengths, as indicated on the diagram following.

These several barrels were manufactured from the same lot of steel.

One of the pieces represents a new barrel which had been turned and bored but not chambered, the other pieces representing rifles which had been fired a large number of rounds and which were eroded at the bore.

The extent to which the erosion had taken place is shown by the accompanying photographs, which are magnified views of the bores just in front of the powder chambers, where the effects of erosion were located.

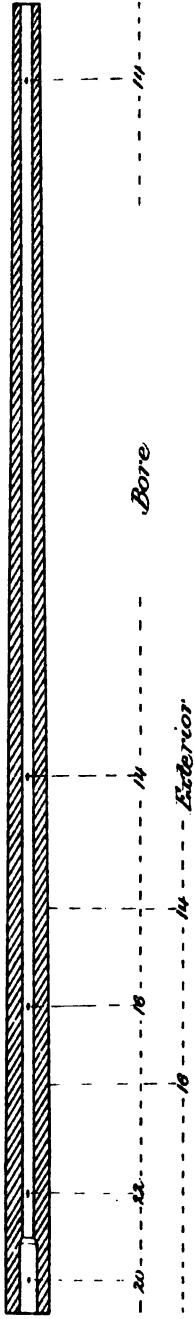
Chemical analysis of chips taken from the muzzle end of the new half barrel showed the following composition:

C	Mn	Si	S	P
0.515	1.200	0.061	0.082	0.075

The higher values for hardness found at the breech ends are attributed to the superior lateral support given the metal displaced by the indenting tool by the heavier section of metal in that vicinity over the thinner sections of the barrels found elsewhere along their length.

Hardness of Rifle Barrel, caliber 30.

Diagram showing location of hardness tests.



Lower half of barrel.
Not chambered.
Same steel as other
half barrels.

No. 112.

Lower half of barrel.
Fired over 2000 rounds.
Bore eroded.

20 --- 18 --- 14 --- 13 --- Bore
--- 16 --- 14 --- Exterior

No. 1032.

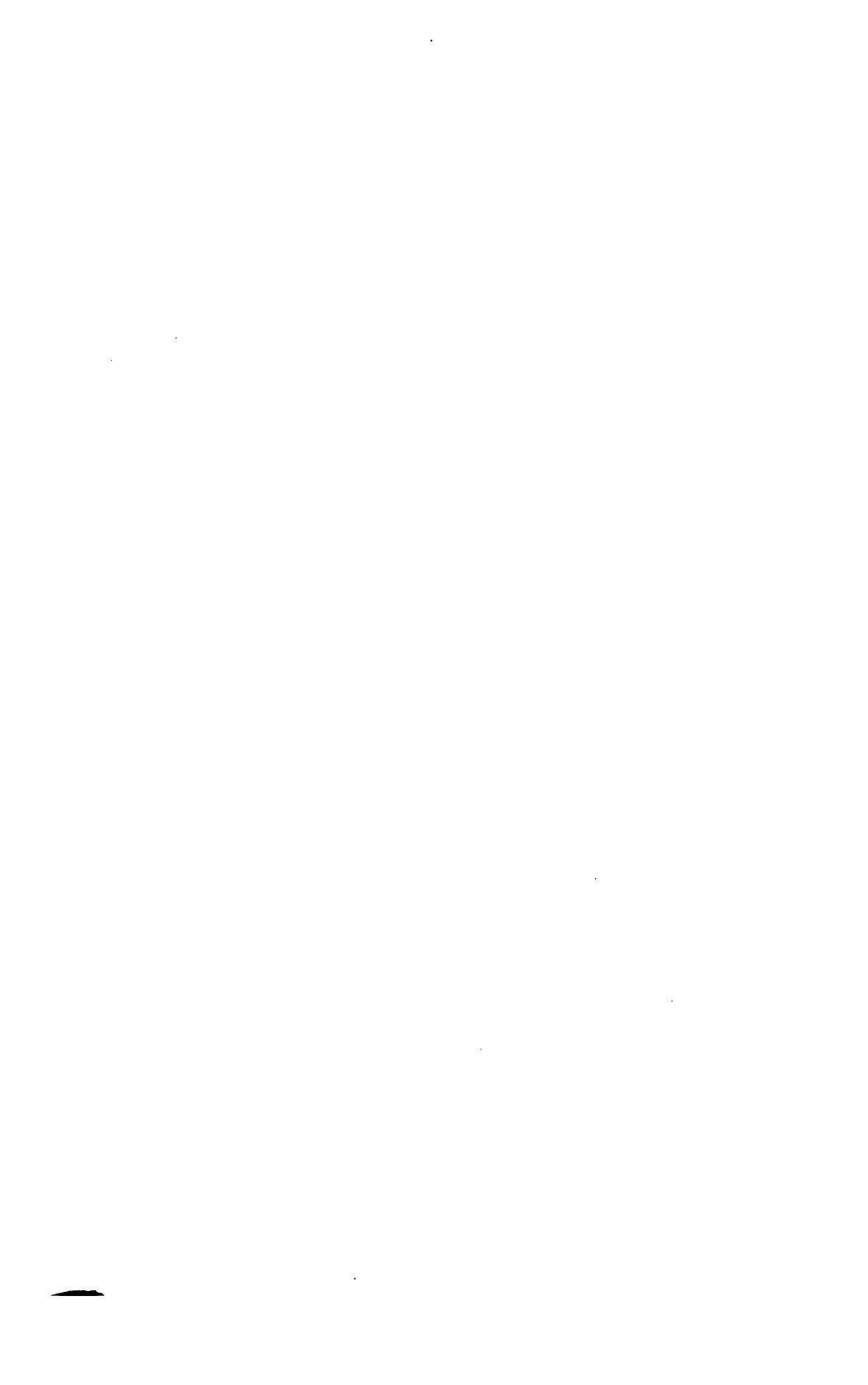
Lower half of barrel.
Fired 7000 rounds.
Bore eroded.

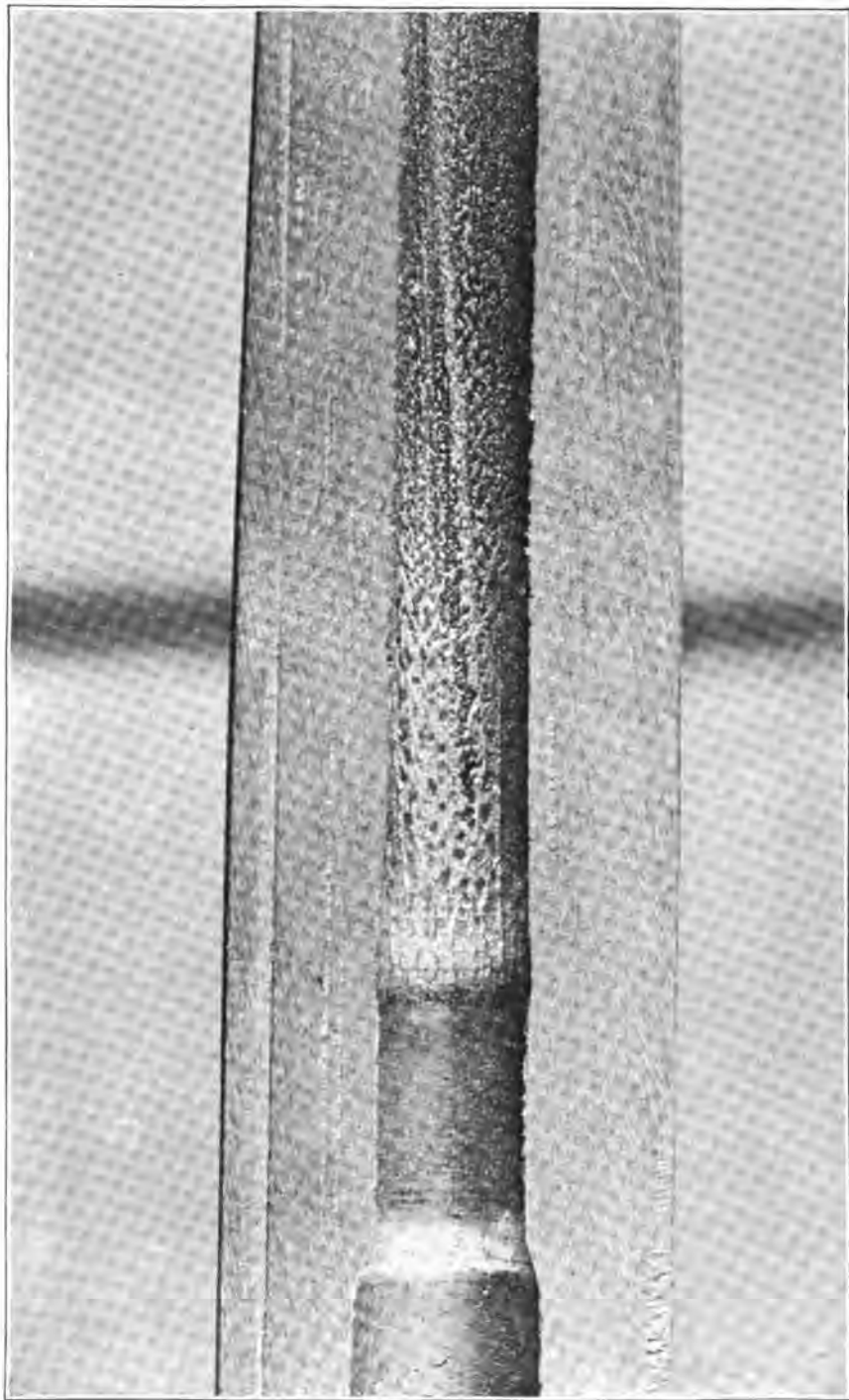
20 --- 18 --- 14 --- Bore
--- 16 --- 14 --- Exterior

No. 874

Lower half of barrel.
Fired 1000 rounds.
Bore badly eroded.

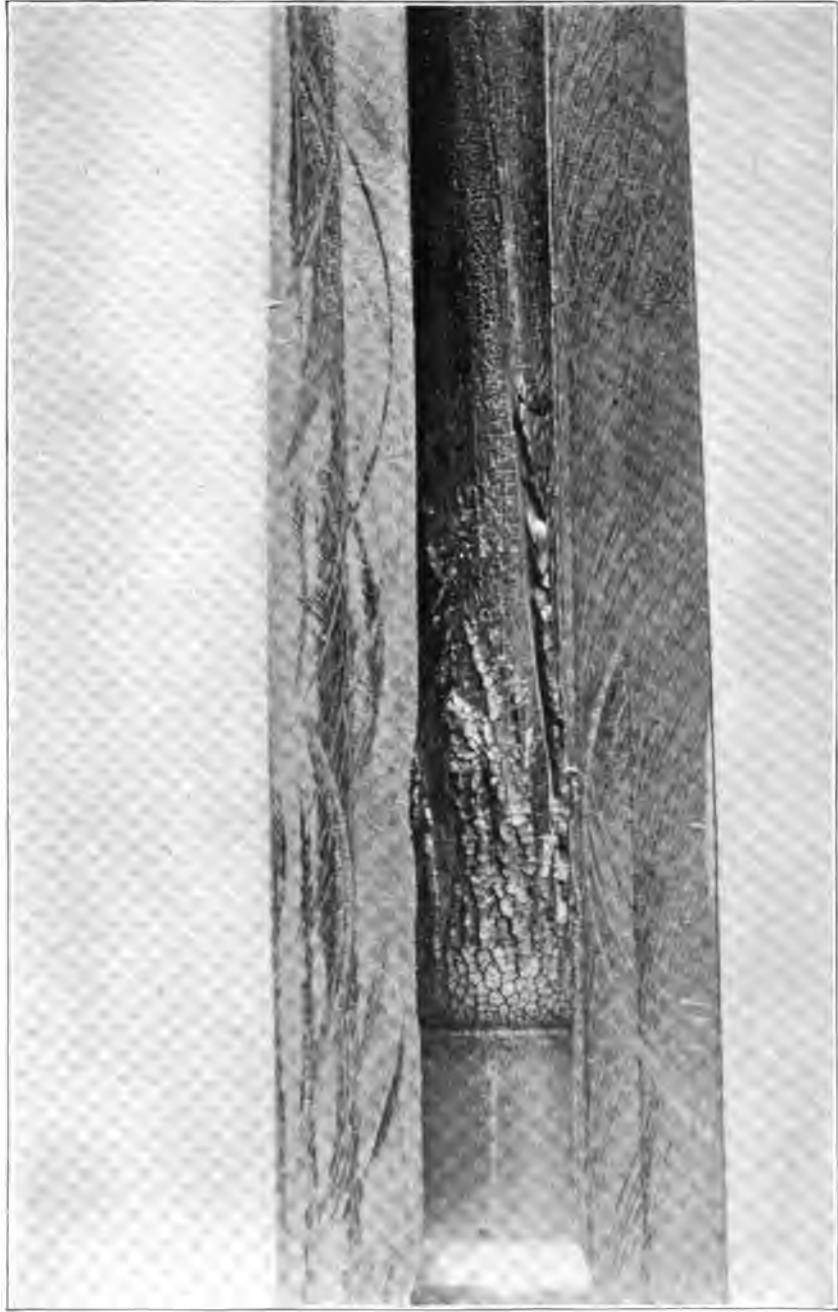
20 --- 18 --- 11 --- Bore
--- 14 --- 10 --- Exterior





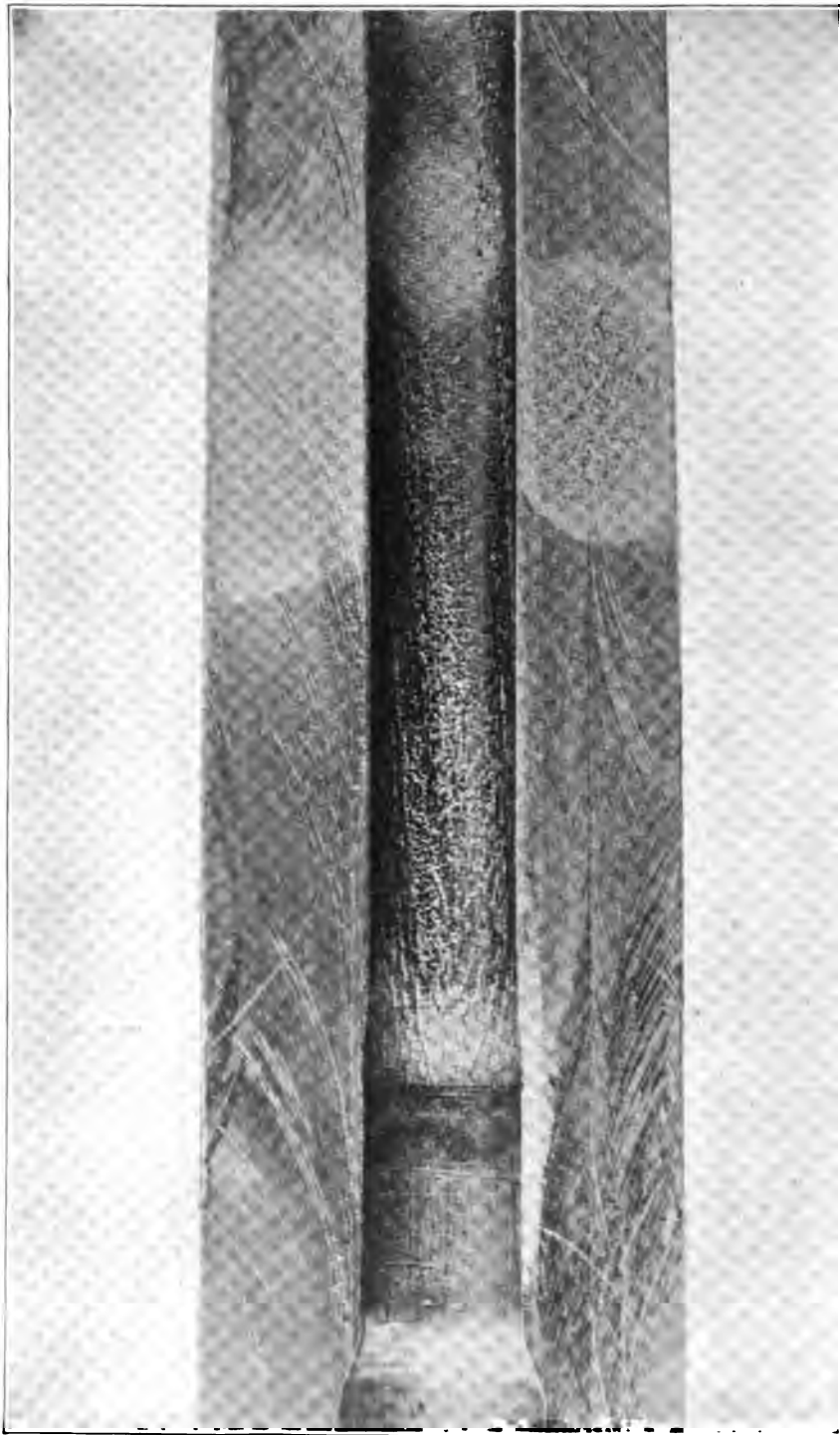
PHOTOGRAPH OF RIFLE BARREL NO. 42, SHOWING EROSION OF METAL AT SURFACE OF BORE.



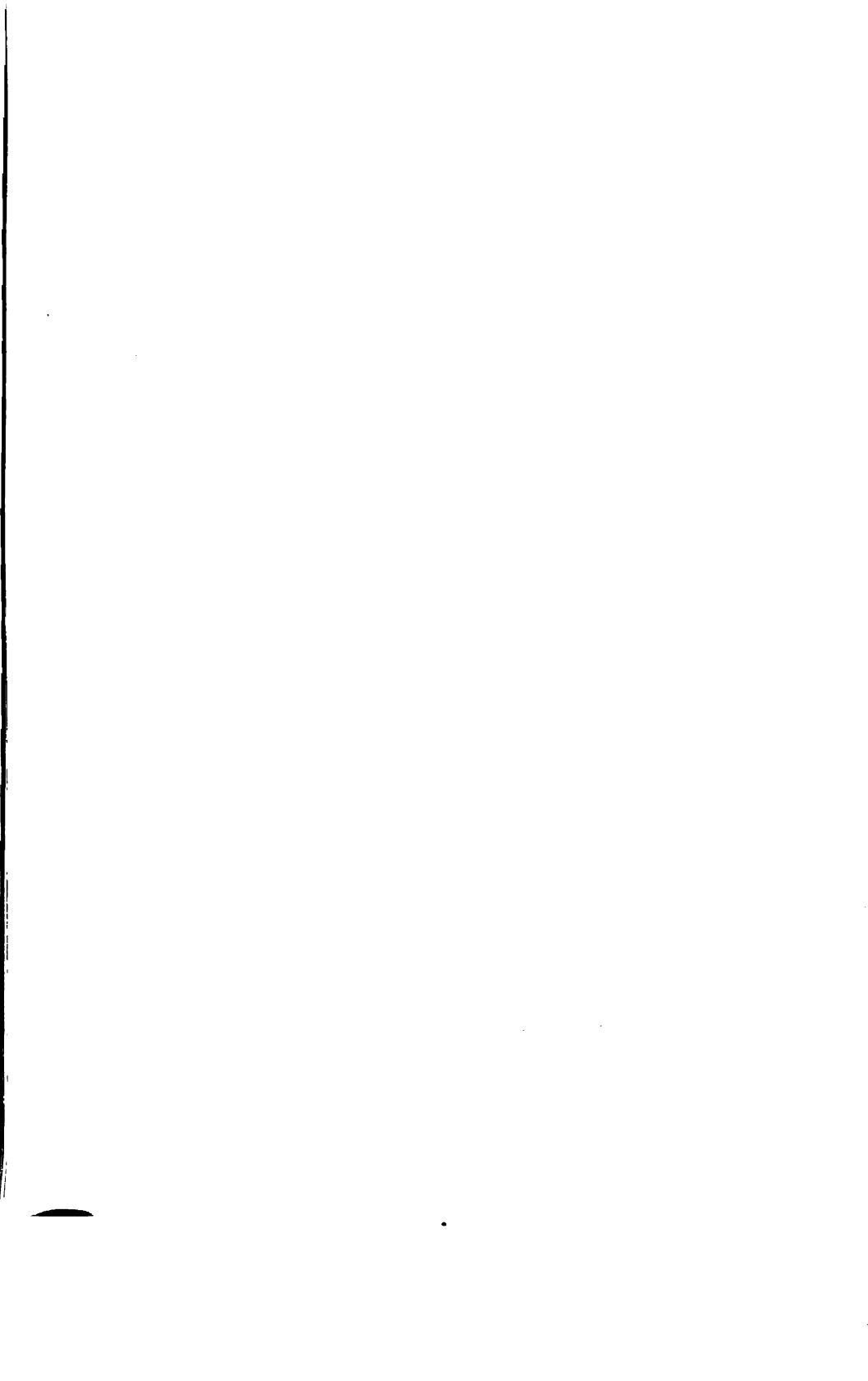


PHOTOGRAPH OF RIFLE BARREL NO. 87, SHOWING EROSION OF METAL AT SURFACE OF BORE.



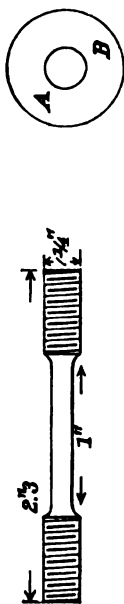


PHOTOGRAPH OF RIFLE BARREL NO. 1032, SHOWING EROSION OF METAL AT SURFACE OF BORE.



TENSILE TESTS OF SPECIMENS FROM BARREL OF RIFLE NO. 7453.

[Longitudinal samples taken 5/8 from the breech end. Sample A from the upper left-hand segment; B from the lower right-hand segment.]



No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit approximate.		Ultimate strength.		Elongation in 1 inch.		Area at fracture.	Contraction of area.	Appearance of fracture.	Remarks.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.				
8189	A	Inch. .150	Sq in. .0177	Pounds. 945	Pounds. 53,390	Pounds. 1,786	Pounds. 100,900	.22	22	In. Sq. in. Diam. .117 = .0108	Per cent. 39	Silky, interspersed with granular metal. Silky.	Samples were taken from fragments after rupture of the barrel in firing.
8190	B	.150	.0177	938	52,990	1,751	98,930	.23	23	Diam. .116 = .0106	40.1		



**STEEL FOR RECEIVERS OF RIFLES,
CAL. .30.**



No. 5404.

TURNED DOWN FROM A BAR 2 1/4" x 1" .7.

Marks, 31 R.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000100	.000100	0.	0.		
2,500	10,000	.000333	.000233	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001000	.000333	.....	.....
10,000	40,000	.001367	.000367	0.	.....	
11,500	46,000	.001567	.000200	.....	.....
11,750	47,000	.001600	.000033	.....	.....
10,750	43,000	.009000	.007400		Elastic limit. Load fell.
11,000	44,000	.012833	.003833	.....	.....
11,250	45,000	.013600	.000767	.....	.....
11,500	46,000	.014733	.001133	.....	.....
11,750	47,000	.015833	.001100	.....	.....
12,000	48,000	.017333	.001500	.....	.....
12,500	50,000	.020167	.002834	.....	.....
13,000	52,000	.023333	.003166	.....	.....
13,500	54,000	.027333	.004000	.....	.....
14,000	56,000	.031333	.004000	.....	.....
14,500	58,000	.035667	.004334	.....	.....
15,000	60,000	.040333	.004666	.....	.....
15,500	62,000	.046333	.006000	.....	.....
16,000	64,000	.052667	.006334	.....	.....
16,500	66,000	.060667	.008000	.....	.....
17,000	68,000	.069333	.008666	.....	.....
17,500	70,000	.081667	.012334	.....	.....
18,000	72,000	.1033	.021633	.....	.....
18,500	74,000	.1433	.0400	.....	.....
18,630	74,520	.1767	.0334	Tensile strength.	

General summary.

Tensile strength per square inch of original section	pounds	74,520
Elastic limit per square inch of original section	do	47,000
Elongation per inch after rupture	inch	.287
Elongation per inch under strain at elastic limit	do	.001600
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1 3/8 from neck
Character of broken surface		silky
Elongation of inch sections	" .20, ".46", ".20	

No. 5405.

FORGED FROM BAR 2".25 x 1".7 TO DIMENSIONS FOR TURNING.

Marks, 30 R. F.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	0.	
2,500	10,000	.000333	.000233	.....	.....
5,000	20,000	.000667	.000334	.....	.....
7,500	30,000	.001000	.000333	.....	.....
10,000	40,000	.001333	.000333	0.	.....
12,000	48,000	.001600	.000267	.....	.....
12,250	49,000	.001633	.000033	.....	.....
12,500	50,000	.001700	.000067	.....	.....	Elastic limit. Load fell.
11,250	45,000	.002867	.001167	.....	.....
11,500	46,000	.004167	.001300	.....	.....
11,750	47,000	.006833	.004666	.....	.....
12,000	48,000	.011333	.002500	.....	.....
12,250	49,000	.012333	.001000	.....	.....
12,500	50,000	.013333	.001000	.....	.....
13,000	52,000	.015833	.002500	.....	.....
13,500	54,000	.018333	.002500	.....	.....
14,000	56,000	.022667	.004334	.....	.....
14,500	58,000	.024667	.002000	.....	.....
15,000	60,000	.028333	.003666	.....	.....
15,500	62,000	.032000	.003667	.....	.....
16,000	64,000	.036000	.004000	.....	.....
16,500	66,000	.041000	.005000	.....	.....
17,000	68,000	.046333	.005333	.....	.....
17,500	70,000	.052667	.006334	.....	.....
18,000	72,000	.061000	.008333	.....	.....
18,500	74,000	.070667	.009667	.....	.....
19,000	76,000	.083333	.012666	.....	.....
19,500	78,000	.1100	.026667	.....	.....
19,800	79,840	.1767	.0667	.....	.....	Tensile strength.

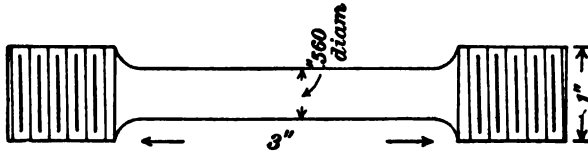
General summary.

Tensile strength per square inch of original section.....	pounds..	79,840
Elastic limit per square inch of original section.....	do.	50,000
Elongation per inch after rupture.....	inch.	.2433
Elongation per inch under strain at elastic limit.....	do.	.001700
Reduction in diameter at point of rupture.....	do.	.144
Reduction in area after rupture, per cent of original section.....		44.6
Position of rupture.....	1".15 from neck	
Character of broken surface.....	silky	
Elongation of inch sections.....	".33", ".25", ".15	

**10-INCH DISAPPEARING GUN CARRIAGE,
METAL USED IN CONSTRUCTION OF.**

FORGED STEEL SUSPENSION ROD.

No. 8347.



Sectional area, .246 square inch.

Elastic limit, 12,590 pounds=51,180 pounds per square inch.

Tensile strength, 21,560 pounds=87,640 pounds per square inch.

Elongation in 3 inches, ".65=21.7 per cent.

Elongation of inch sections, ".39*, ".15, ".11.

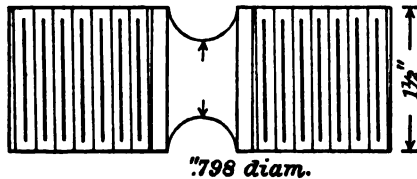
Diameter at fracture, ".40; area, .126 square inch.

Contraction of area, 48.8 per cent.

Fractured ".8 from neck.

Appearance, silky.

No. 5290.

FORGED STEEL SUSPENSION ROD. TAKEN FROM SAME FORGING AS
No. 8347.

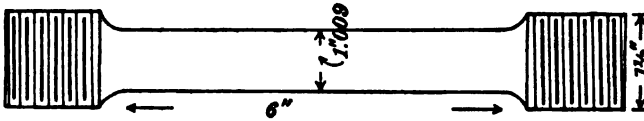
Sectional area, .50 square inch.

Tensile strength, 57,580 pounds=115,160 pounds per square inch.

Appearance of fracture, fine granular.

SAMPLE FROM END OF PISTON ROD FOR 10-INCH DISAPPEARING CARRIAGE. NO. 3 STEEL.

No. 5519.



Diameter, 1".009.
 Sectional area, .80 square inch.
 Gauged length, 6".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
800	1,000	0.	0.	0.	0.	Initial load.
4,000	5,000	.000100	.000100	.....	.....
8,000	10,000	.000287	.000187	.....	.....
16,000	20,000	.000617	.000350	.....	.....
24,000	30,000	.000950	.000338	.000033	.000023	
28,000	35,000	.001100	.000150	.....	.....
32,000	40,000	.001288	.000184	.000033	0.	
32,800	41,000	.001317	.000034	.....	.....	Elastic limit.
33,600	42,000	.001368	.000066	.....	.....
34,400	43,000	.001368	.003784	.....	.....
36,800	46,000	.0083	.003133	.....	.....
40,000	50,000	.0100	.0017	.....	.....
41,600	52,000	.0117	.0017	.....	.....
43,200	54,000	.0133	.0016	.....	.....
44,800	56,000	.0150	.0017	.....	.....
46,400	58,000	.0167	.0017	.....	.....
48,000	60,000	.0183	.0016	.....	.....
49,600	62,000	.0200	.0017	.....	.....
51,200	64,000	.0217	.0017	.....	.....
52,800	66,000	.0250	.0023	.....	.....
54,400	68,000	.0267	.0017	.....	.....
56,000	70,000	.0283	.0016	.....	.....
57,600	72,000	.0317	.0034	.....	.....
59,200	74,000	.0333	.0016	.....	.....
60,800	76,000	.0383	.0050	.....	.....
62,400	78,000	.0417	.0034	.....	.....
64,000	80,000	.0450	.0033	.....	.....
65,600	82,000	.0483	.0033	.....	.....
67,200	84,000	.0567	.0084	.....	.....
68,800	86,000	.0633	.0066	.....	.....
70,400	88,000	.0683	.0050	.....	.....
72,000	90,000	.0800	.0117	.....	.....
73,600	92,000	.0967	.0167	.....	.....
75,200	94,000	.1350	.0383	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section.....	pounds..	92,000
Elastic limit, per square inch of original section.....	do.....	41,000
Elongation per inch after rupture.....	inch..	.1550
Elongation per inch under strain at elastic limit.....	do.....	.001317
Reduction in diameter at point of rupture.....	do.....	.129
Reduction in area after rupture, per cent of original section.....	.....	24.0
Position of rupture.....	.....	at middle of stem
Character of broken surface.....	granular, radiating from a silky spot at a center punch mark used in laying off inch sections on surface of stem; developed numerous minute cracks in surface of the stem.	
Elongation of inch sections.....	.....	".12, ".15, ".26, ".30, ".12, ".08

SECOND SAMPLE TAKEN FROM SAME PISTON ROD AS NO. 5519.

No. 5522.

Stem, 3" long.
 Diameter, ".505.
 Sectional area, .20 square inch.
 Gaged length, 3".

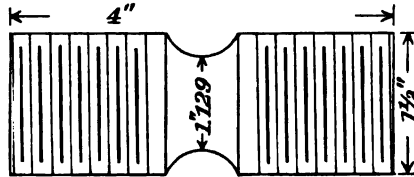
Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	0.	
2,000	10,000	.000300	.000200	.....	.....
4,000	20,000	.000633	.000333	.....	.....
6,000	30,000	.000967	.000334	.....	.....
8,000	40,000	.001300	.000333	0.	.....
8,200	41,000	.001333	.000033	.....	.....
8,400	42,000	.001367	.000034	.....	.....
8,600	43,000	.002767	.001400	.....	.....
8,800	44,000	.005500	.002733	.....	.....
9,000	45,000	.005933	.000433	Elastic limit.
9,200	46,000	.006363	.000700	.....	.....
9,600	48,000	.008000	.001367	.....	.....
10,000	50,000	.009333	.001333	.....	.....
10,400	52,000	.010000	.000667	.....	.....
10,800	54,000	.011933	.001933	.....	.....
11,200	56,000	.013333	.001400	.....	.....
11,600	58,000	.014333	.001000	.....	.....
12,000	60,000	.017333	.003000	.....	.....
12,400	62,000	.018000	.000667	.....	.....
12,800	64,000	.020000	.002000	.....	.....
13,200	66,000	.022500	.002500	.....	.....
13,600	68,000	.024000	.001500	.....	.....
14,000	70,000	.026333	.002333	.....	.....
14,400	72,000	.028467	.002134	.....	.....
14,800	74,000	.031000	.002533	.....	.....
15,200	76,000	.033667	.002667	.....	.....
15,600	78,000	.036000	.002333	.....	.....
16,000	80,000	.040333	.004333	.....	.....
16,400	82,000	.043733	.003400	.....	.....
16,800	84,000	.048333	.004600	.....	.....
17,200	86,000	.054000	.005667	.....	.....
17,600	88,000	.059667	.005667	.....	.....
18,000	90,000	.066333	.008666	.....	.....
18,400	92,000	.067	.018367	.....	.....
18,800	94,000	.1067	.0200	.....	.....
18,980	94,950	.1400	.0333	Tensile strength.

General summary.

Tensile strength per square inch of original section pounds.. 94,950
 Elastic limit per square inch of original section do. 42,000
 Elongation per inch after rupture inch. .1567
 Elongation per inch under strain at elastic limit..... do. .001367
 Reduction in diameter at point of rupture do. .065
 Reduction in area after rupture, per cent of original section 23.9
 Position of rupture ".70 from neck
 Character of broken surface..... granular, 80 per cent; dull silky, 40 per cent; irregular surface;
 minute cracks developed in surface of stem.
 Elongation of inch sections ".22", ".14", ".11

No. 5337.

SAMPLE TAKEN FROM SAME PISTON ROD AS NO. 5519.



Sectional area, 1.00 square inch.

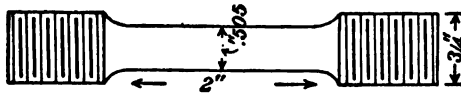
Tensile strength, 117,650 pounds per square inch.

Fractured in end at root of thread. Appearance granular.

10-inch DISAPPEARING CARRIAGE.

SPECIMENS FROM END OF GUN LEVER AXLE (CROP ENDS OF FORGINGS).

No. 8373.



Sectional area, .20 square inch.

Elastic limit, 7,700 pounds=38,500 pounds per square inch.

Tensile strength, 18,980 pounds=94,900 pounds per square inch.

Elongation in 2 inches, ".31=15.5 per cent.

Elongation of inch sections, ".12, ".19*.

Diameter at fracture, ".45; area, .159 square inch.

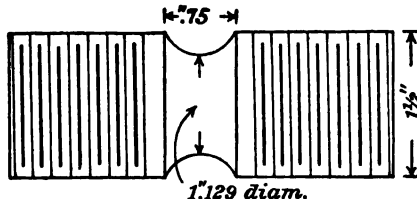
Contraction of area, 20.5 per cent.

Appearance of fracture, granular, with dull, silky metal.

Surface of specimen in vicinity of fracture broken with minute surface cracks.

TENACITY SPECIMEN FROM SAME PIECE FROM WHENCE NO. 8373 WAS TAKEN.

No. 8374.



Sectional area, 1.00 square inch.

Tensile strength, 102,100 pounds per square inch.

Fractured at root of thread in the head. Not fractured in the grooved section.

Appearance of fracture, granular.

STEEL FOR 10-INCH DISAPPEARING CARRIAGE.

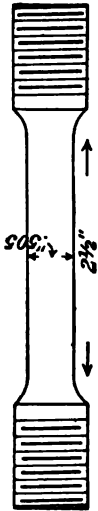


No. of test.	Mark on specimen.	Diam. etc.	Sec-tional area.	Elastic limit.		Ultimate strength.		Elongation in 2 inches.		Area at fracture.	Con-traction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.				
8103	F 6851-1	5 1/8	Sq. in.	Pounds.	Pounds.	Pounds.	Pounds.	Inch.	Per cent.	In. Sq. in.	Per ct.		"
8104	F 6851-2	5 1/8	20	14,000	70,000	25,000	125,300	26	13.0	Diam. 47 = 173	13.5	Fine granular	14*
8105	F 6851-3	5 1/8	20	11,710	58,550	20,120	100,600	46	23.0	Diam. 38 = 113	43.5	Silky with traces of granulation.	52*
8106	F 6851-4	5 1/8	20	11,710	58,550	17,990	90,950	55	27.5	Diam. 37 = 108	46.0	Silky	52*
8107	F 6851-5	5 1/8	20	11,720	58,600	18,230	91,150	49	24.5	Diam. 40 = 126	37.0	do	33*
8108	F 6851-6	5 1/8	20	11,680	58,400	18,130	90,650	54	27.0	Diam. 39 = 122	49.0	do	37*
8109	F 6851-7	5 1/8	20	11,960	59,800	19,890	99,450	53	26.5	Diam. 37 = 108	48.0	do	37*
8109	F 6851-7	5 1/8	20	12,060	64,750	22,280	111,400	41	20.5	Diam. 42 = 139	30.5	Silky interspersed with fine granulation.	13, 28*
8200	F 6858-F 8	5 1/8	20	11,700	58,500	19,130	95,650	54	27.0	Diam. 37 = 108	46.0	Silky	35*
8201	F 6858-9	5 1/8	20	11,520	57,600	18,500	92,850	57	28.5	Diam. 36 = 102	48.0	do	35*
8202	F 6858-10	5 1/8	20	11,530	57,750	18,790	93,800	61	32.0	Diam. 37 = 102	46.0	do	37*
8203	F 6858-11	5 1/8	20	11,460	57,400	18,680	93,300	56	28.0	Diam. 36 = 102	43.0	do	16, 38*
8204	F 6858-12	5 1/8	20	11,200	56,000	18,970	94,850	54	27.0	Diam. 37 = 102	46.0	do	17, 37*
8205	F 6858-13	5 1/8	20	13,290	66,450	21,920	108,600	37	18.5	Diam. 41 = 132	34.0	Silky interspersed with fine granulation.	17, 37*
8206	F 6894-14	5 1/8	20	11,130	55,650	19,110	95,550	46	23.0	Diam. 40 = 126	37.0	Silky	30*
8207	F 6894-15	5 1/8	20	12,810	64,050	20,020	100,100	49	24.5	Diam. 40 = 126	37.0	Silky with traces of granulation.	18, 31*
8208	F 6894-16	5 1/8	20	12,060	60,400	20,100	100,500	44	22.0	Diam. 40 = 126	37.0	do	15, 29*
8209	F 6894-17	5 1/8	20	14,070	70,350	23,790	118,950	19	9.5	Diam. 48 = 161	9.5	Fine granular	69, 10*
8210	F 6894-18	5 1/8	20	10,860	54,750	18,600	91,000	50	25.0	Diam. 38 = 113	43.5	Silky	35*, 16
8211	F 6853-19	5 1/8	20	11,980	59,900	19,720	98,600	45	22.5	Diam. 39 = 119	40.5	do	14, 31*

No. of test.	Mark on specimen.	Diameter.	Sec-tional area.	Elastic limit.		Ultimate strength.		Elongation in 2 inches.		Area at fracture.	Con-traction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.				
8342	20, F 6851	.505	Sq. in. .20	Pounds. 12,550	Pounds. 62,750	Pounds. 20,640	Per square inch. 103,200	.41	20.5	Inch. Sq. in. Diam. .41 = .132	34.0	Fine granular	" .14, .27*
8343	21, F 6890	.502	.20	12,100	61,500	19,020	95,100	.50	25.0	Diam. .50 = .162	49.0	Fine silky	.35, .15
8344	22, F 6890	.505	.20	14,200	71,000	24,100	120,500	.35	17.5	Diam. .45 = .159	20.5	Fine granular	.22*, .13
8350	F 12865, 1	.505	.20	7,910	39,550	17,620	88,100	.38	19.0	Diam. .44 = .152	21.0	Granular, dull spot at circumfer-ence.	.25*, .15
8351	P 12865, 2	.505	.20	7,960	39,750	18,210	91,060	.41	20.5	Diam. .44 = .152	24.0	.....60	.24*, .17

Specimens 8342, 8343, and 8344 have the general mark 7192.

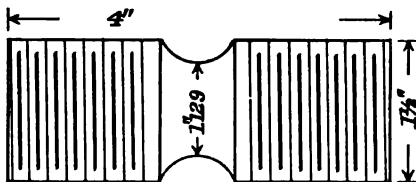
WROUGHT IRON FOR 10-INCH DISAPPEARING CARRIAGE.



[All specimens have the general mark 7192.]

No. of test.	Mark on specimen.	Diam-eter.	Sec-tional area.	Elastic limit.		Ultimate strength.		Elongation in 2 inches.		Area at fracture.	Con-traction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.				
8334	1, F 6963	.505	.20	6,480	32,400	10,180	50,900	.67	33.5	Diam. .37 = .107	46.5	Fibrous	.44*, 23
8335	2, F 6963	.505	.20	6,070	30,350	9,830	49,150	.66	33.0	Diam. .36 = .102	49.0	do	.23, .43*
8336	3, F 6963	.505	.20	5,990	29,950	9,920	49,600	.70	35.0	Diam. .37 = .107	46.5	do	.28, .42*
8337	4, F 6963	.505	.20	5,990	29,950	9,910	49,550	.66	33.0	Diam. .37 = .107	46.5	do	.25, .41*
8338	5, F 6963	.505	.20	5,780	28,900	9,660	48,300	.59	29.5	Diam. .39 = .119	40.5	do	.21, .38*
8339	6, F 6963	.505	.20	6,240	31,200	10,120	50,600	.69	34.5	Diam. .38 = .113	43.5	do	.42*, 27
8340	7, F 6963	.505	.20	5,690	28,400	9,530	47,650	.73	36.5	Diam. .37 = .107	46.5	do	.42, .31
8341	8, F 6963	.505	.20	6,450	32,250	9,970	49,850	.65	32.5	Diam. .38 = .113	43.5	do	.23, .42*

CAST IRON USED IN CONSTRUCTION OF 10" DISAPPEARING CARRIAGE.



No. of test.	Numbers.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
				Total.	Per square inch.	
		<i>Inches.</i>	<i>Sq. in.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
5261	20.....	1. 129	1. 00	24, 920	24, 920	Fine granular, dark gray.
5269	1, P-12840	1. 129	1. 00	14, 480	14, 480	Do.
5270	do	1. 129	1. 00	14, 070	14, 070	Do.
5271	2, P-12840	1. 129	1. 00	20, 010	20, 010	Do.
5272	do	1. 129	1. 00	19, 600	19, 600	Do.
5273	3, P-12840	1. 129	1. 00	15, 990	15, 990	Do.
5274	do	1. 129	1. 00	16, 300	16, 300	Do.
5275	4, P-12840	1. 129	1. 00	14, 780	14, 780	Do.
5276	do	1. 129	1. 00	15, 100	15, 100	Do.
5277	5, P-12840	1. 129	1. 00	19, 300	19, 300	Do.
5278	do	1. 129	1. 00	18, 320	18, 320	Do.
5279	6, P-12840	1. 129	1. 00	16, 630	16, 630	Do.
5280	do	1. 129	1. 00	16, 050	16, 050	Do.
5281	7, P-12840	1. 129	1. 00	13, 400	13, 400	Do.
5282	do	1. 129	1. 00	13, 490	13, 490	Do.
5283	8, P-12840	1. 129	1. 00	13, 380	13, 380	Do.
5284	do	1. 129	1. 00	13, 810	13, 810	Do.

CAST IRON FOR COUNTERWEIGHT BASE PLATE, 10" DISAPPEARING CARRIAGE.

No. of test.	Numbers.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
				Total.	Per square inch.	
		<i>Inches.</i>	<i>Sq. in.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
5305	P 12840-9....	. 81	. 515	8, 110	15, 750	Fine granular, gray.
5306	do	. 81	. 515	8, 990	17, 460	Do.
5331	12840-10.....	1. 129	1. 00	18, 330	18, 330	Fine granular, dark gray; one side medium fine granular.
5332	do	1. 129	1. 00	16, 380	16, 380	Do.

BASE RING AND TRAVERSE CIRCLE FOR 10" DISAPPEARING CARRIAGE.

No. of test.	Numbers.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
				Total.	Per square inch.	
		<i>Inches.</i>	<i>Sq. in.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
5233	1 A.....	1. 129	1. 00	33, 950	33, 950	Fine granular, dark gray, spongy spot near circ.
5234	1 B.....	1. 129	1. 00	33, 120	33, 120	Fine granular.
5235	1 C.....	1. 129	1. 00	34, 280	34, 280	Do.
a 5307	.....	1. 129	1. 00	36, 810	36, 810	Fine granular, granitic.

a Has stem $9\frac{1}{2}$ inches long; other specimens are grooved form.

CAST IRON:

CASTING OF BASE RING AND REAR TRAVERSE CIRCLE.

No. 5388.

Marks, D₂.

Diameter, 1".135.

Sectional area, 1.01 square inch.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 010	1, 000	0.	0.	0.	0.	
2, 020	2, 000	.00007	.00007	-----	-----	
3, 030	3, 000	.00012	.00005	-----	-----	
4, 040	4, 000	.00020	.00008	-----	-----	
5, 050	5, 000	.00028	.00008	0.	-----	
6, 060	6, 000	.00036	.00008	-----	-----	
7, 070	7, 000	.00045	.00009	-----	-----	
8, 080	8, 000	.00054	.00009	-----	-----	
9, 090	9, 000	.00064	.00010	-----	-----	
10, 100	10, 000	.00077	.00013	.00008	.00008	
11, 110	11, 000	.00089	.00012	-----	-----	
12, 120	12, 000	.00102	.00013	-----	-----	
13, 130	13, 000	.00119	.00017	-----	-----	
14, 140	14, 000	.00137	.00018	-----	-----	
15, 150	15, 000	.00159	.00022	.00040	.00032	
16, 160	16, 000	.00184	.00025	-----	-----	
17, 170	17, 000	.00218	.00034	-----	-----	
18, 180	18, 000	.00261	.00043	-----	-----	
19, 190	19, 000	.00309	.00048	-----	-----	
20, 200	20, 000	.00385	.00076	.00208	.00163	
21, 210	21, 000	.00498	.00113	-----	-----	Tensile strength.

Fractured at the neck. Appearance fine granular.

CAST IRON.

No. 5389.

Marks, E 3.

Diameter, 1".135.

Sectional area, 1.01 square inch.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 010	1, 000	0.	0.	0.	0.	
2, 020	2, 000	.00005	.00005			
3, 030	3, 000	.00010	.00005			
4, 040	4, 000	.00016	.00006			
5, 050	5, 000	.00021	.00005	0.		
6, 060	6, 000	.00029	.00008			
7, 070	7, 000	.00034	.00005			
8, 080	8, 000	.00041	.00007			
9, 090	9, 000	.00048	.00007			
10, 100	10, 000	.00055	.00007	.00002	.00002	
11, 110	11, 000	.00061	.00006			
12, 120	12, 000	.00070	.00009			
13, 130	13, 000	.00078	.00008			
14, 140	14, 000	.00084	.00006			
15, 150	15, 000	.00093	.00009	.00010	.00008	
16, 160	16, 000	.00103	.00010			
17, 170	17, 000	.00113	.00010			
18, 180	18, 000	.00124	.00011			
19, 190	19, 000	.00134	.00010			
20, 200	20, 000	.00150	.00016	.00029	.00019	
21, 210	21, 000	.00163	.00013			
22, 220	22, 000	.00176	.00016			
23, 230	23, 000	.00200	.00021			
24, 240	24, 000	.00220	.00020			
25, 250	25, 000	.00244	.00024	.00078	.00049	
26, 260	26, 000	.00272	.00028			
27, 270	27, 000	.00311	.00039			
28, 280	28, 000	.00354	.00043			
29, 290	29, 000	.00409	.00055			
30, 300	30, 000	.00476	.00067	.00254	.00176	
31, 980	31, 660					Tensile strength.

Fractured at the neck. Appearance fine granular.

PROOF STRESS APPLIED TO PISTON RODS FOR 10" DISAPPEARING CARRIAGES.

The rods were secured in the testing machine at one end by means of the nuts on the rods, at the other end by friction grip.

Finished rods turned to 4" diameter.

Unfinished rods turned to 4".06 diameter.

Tensile stress applied 116,000 pounds total.

No. of test.	Marks.	Condition.	Manufacturer.
8375	6582 B ₂ F ₁	Finished.....	} Kilby Manufacturing Co., Cleveland, Ohio.
8376	6582 B ₂ F ₁	do.....	
8377	6582 B ₂ F ₂	Unfinished.....	
8378	6582 B ₂ F ₂	do.....	
8379	6040 B ₂ F ₂	Finished.....	
8380	6493 B ₂ F ₁	do.....	} The Bethlehem Iron Co., South Bethlehem, Pa.
8381	6493 B ₂ F ₂	do.....	
8382	.....	do.....
8383	.....	do.....
8384	.....	do.....
8385	6 rods, no marks..	Finished except threading.	Watertown Arsenal shops.

PROOF STRESS APPLIED TO EIGHT SUSPENSION RODS FOR 10" DISAPPEARING CARRIAGES.

Rods from Watertown Arsenal shops.

Rods 4½" diameter with eyes 8" diameter.

Secured in the testing machine by friction grip over heads, and by pulling against nut at opposite end.

Tensile stress applied 175,000 pounds total.

PROOF STRESS APPLIED TO TWO PISTON RODS FOR 15" GUN CARRIAGES, OLD MODEL.

Diameter of rods, 3".

Diameter at end carrying nut, 2".90.

Diameter at root of thread, 2".70.

Loaded against nut at one end and collars of cross head at the other.

No. 8511.

Two hundred and ten thousand pounds tension applied, causing a permanent set of ".32.

No. 8512.

Two hundred and ten thousand pounds tension applied, causing a permanent set of ".26.

**STEEL FOR USE IN CONSTRUCTION OF ROCK
ISLAND BRIDGE.**



No. 5472.

Marks, 2".
 Diameter, .564.
 Sectional area, .25 square inch.
 Length of stem, 8".
 Gauged length, 6".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.	
Total.	Per square inch.						
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>		
250	1,000	0.	0.	0.	0.	Initial load.	
1,250	5,000	.000150	.000150	0.	.....	
2,500	10,000	.000317	.000167	.....	.....
5,000	20,000	.000650	.000333	.....	.....
7,500	30,000	.000983	.000333	0.	.....	
9,500	38,000	.001267	.000284	.000033	.000033		
8,750	35,000	.004083	.002816		Elastic limit. Load fell.
9,000	36,000	.006000	.001917	.....	.....
9,250	37,000	.009167	.003167	.....	.....
9,500	38,000	.019000	.009833	.....	.....
9,750	39,000	.019600	.000600	.....	.....
10,000	40,000	.021300	.001700	.....	.....
10,250	41,000	.022417	.001117	.....	.....
10,500	42,000	.024383	.001966	.....	.....
10,750	43,000	.026333	.001950	.....	.....
11,000	44,000	.028333	.002000	.....	.....
11,500	46,000	.032833	.004500	.....	.....
12,000	48,000	.0400	.007167	.....	.....
12,500	50,000	.0467	.0067	.....	.....
13,000	52,000	.0550	.0083	.....	.....
13,500	54,000	.0633	.0083	.....	.....
14,000	56,000	.0750	.0117	.....	.....
14,500	58,000	.0950	.0200	.....	.....
15,000	60,000	.1167	.0217	.....	.....
15,500	62,000	.1783	.0616	.....	.....
15,540	62,160	.2183	.0400	Tensile strength.	

General summary.

Tensile strength per square inch of original section.....	pounds..	62,160
Elastic limit per square inch of original section.....	do..	38,000
Elongation per inch after rupture (in 8 inches).....	inch..	.2425
Elongation per inch under strain at elastic limit.....	do..	.001267
Reduction in diameter at point of rupture.....	do..	.144
Reduction in area after rupture, per cent of original section.....		44.6
Position of rupture.....		3".1 from neck
Character of broken surface.....		silky
Elongation of inch sections.....		"18, "22, "43", "25, "24, "23, "20, "20

No. 5473.

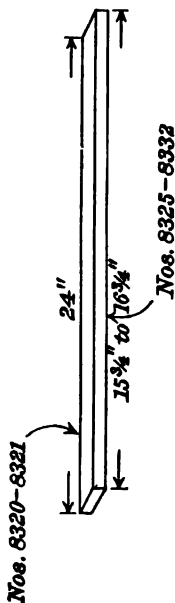
Marks, 6.
 Diameter, ".564.
 Sectional area, .25 square inch.
 Length of stem, 8".
 Gauged length, 6".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. Elastic limit. Load fell. Tensile strength.
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000150	.000150	0.	0.	
2,500	10,000	.000317	.000167			
5,000	20,000	.000667	.000350			
7,500	30,000	.001017	.000350	.000017	.000017	
8,750	35,000	.001200	.000183	.000033	.000016	
9,000	36,000	.001233	.000033			
9,250	37,000	.001333	.000100			
8,750	35,000	.002033	.000700			
9,000	36,000	.005333	.003200			
9,250	37,000	.016667	.011334			
9,500	38,000	.017867	.001200			
9,750	39,000	.019000	.001133			
10,000	40,000	.020967	.001967			
10,500	42,000	.025033	.004066			
11,000	44,000	.028333	.003200			
11,500	46,000	.0333	.004967			
12,000	48,000	.0400	.0067			
12,500	50,000	.0467	.0067			
13,000	52,000	.0533	.0066			
13,500	54,000	.0633	.0100			
14,000	56,000	.0733	.0100			
14,500	58,000	.0900	.0167			
15,000	60,000	.1167	.0267			
15,500	62,000	.1633	.0466			
15,570	62,280	.1988	.0350			

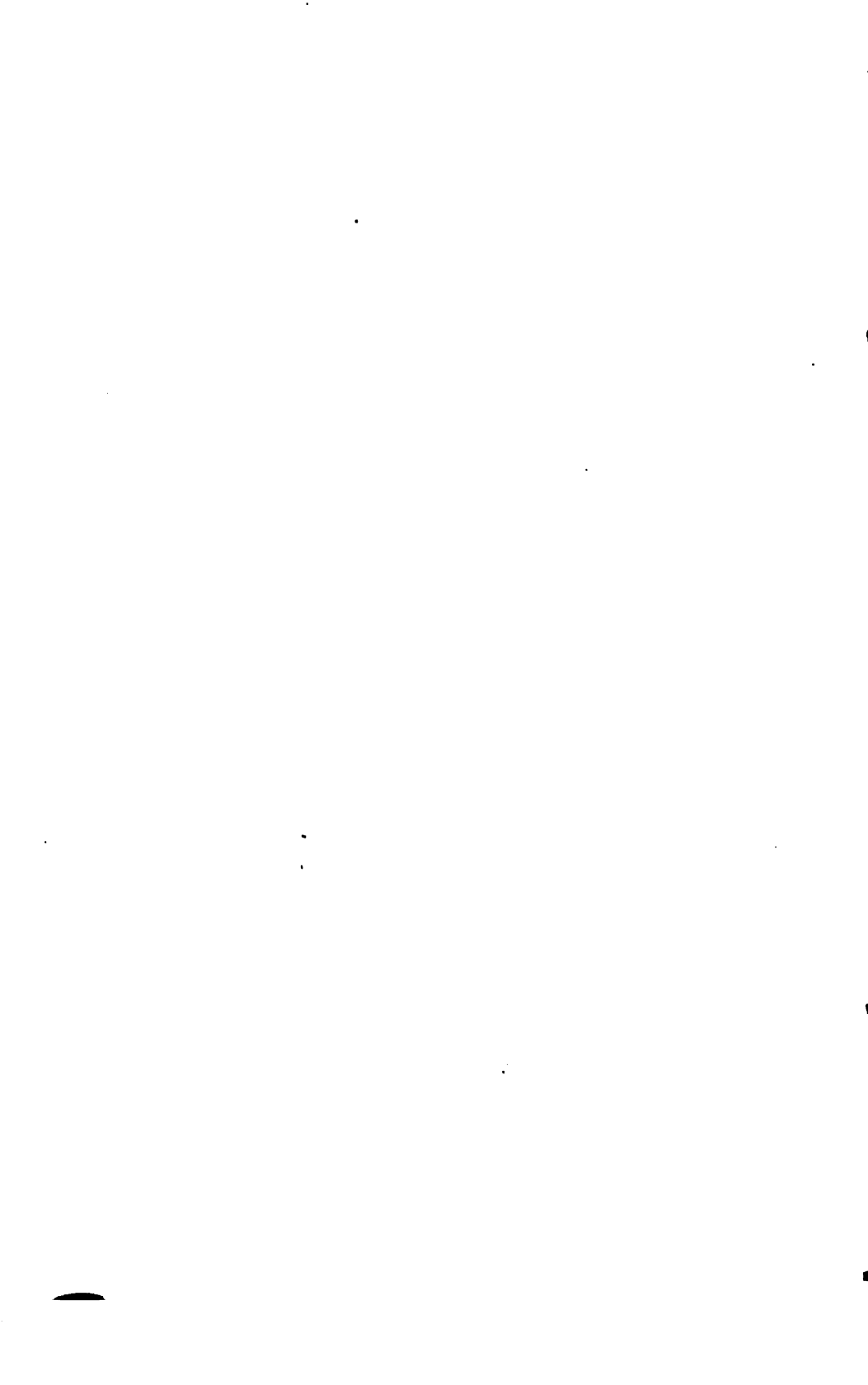
General summary.

Tensile strength per square inch of original section.....	pounds..	62,280
Elastic limit per square inch of original section.....	do...	36,000
Elongation per inch after rupture (in 8 inches).....	inch..	.2538
Elongation per inch under strain at elastic limit.....	do	.001233
Reduction in diameter at point of rupture.....	do	.144
Reduction in area after rupture, per cent of original section.....		44.6
Position of rupture.....		4".4 from neck
Character of broken surface.....		silky
Elongation of inch sections.....	"19, "26, "28, "28, "44, "22, "19, "17	

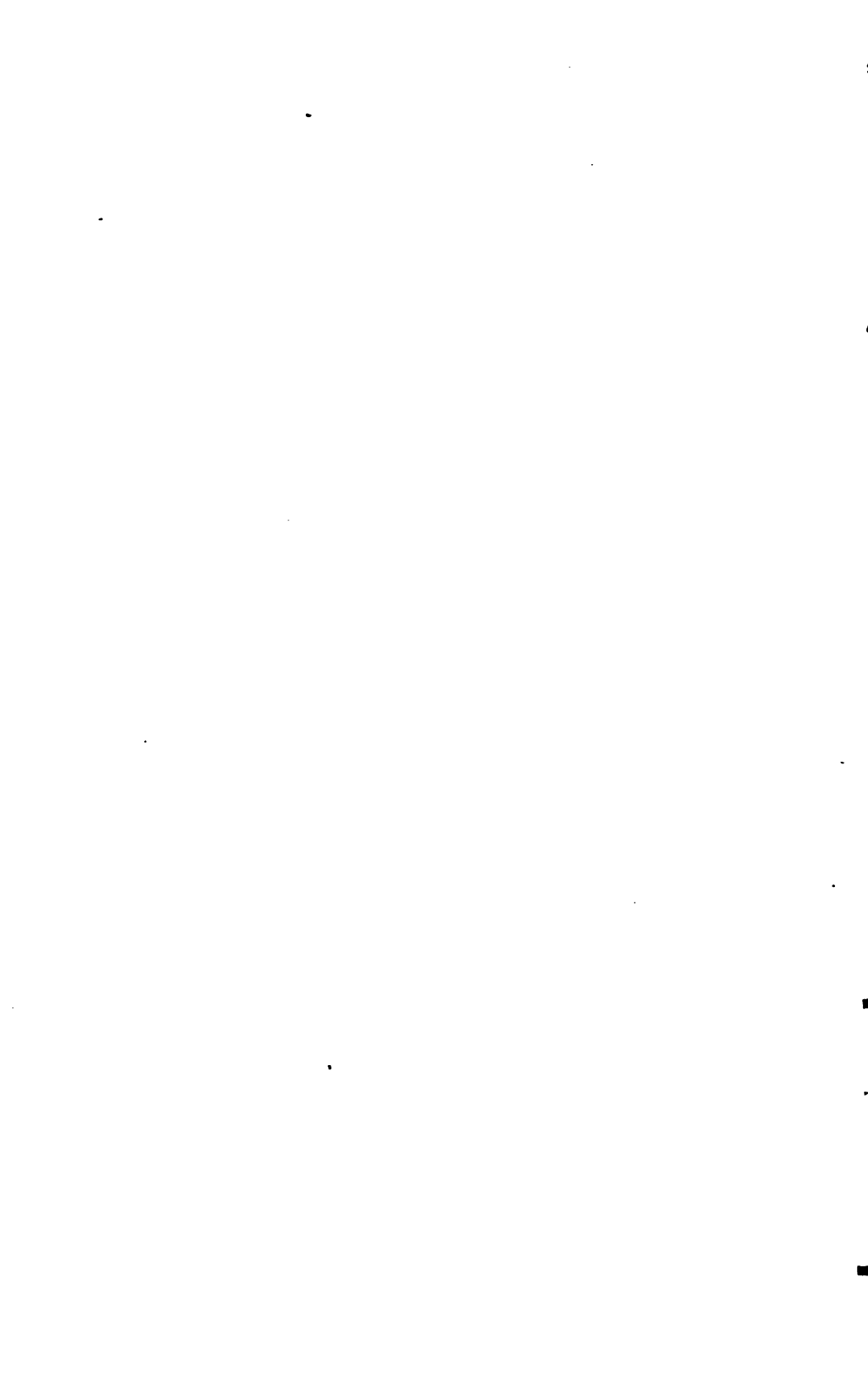
STEEL PLATE.



No. of test specimen.	Dimensions in inches.		Sec. tional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Con- traction of area.	Appear- ance of fracture.	Elongation of inch sections.
	Width.	Thick- ness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
8320	1.498	.871	Sq. in. .556	Pounds 18,120	Per square inch. 32,590	Pounds 33,040	Per square inch. 59,420	2.46	24.6	In. In. Sq. in. 1.15 x .26 = 289	P. ct. 46.2	Silky	"17, "17, "20, "23, "53*, "28, "20, "20, "20, "22, "21
8321	1.500	.872	.558	17,450	31,270	32,810	58,800	2.68	26.8	1.14 x .25 = 285	46.9	do	"23, "53*, "35, "24, "19, "23, "23, "27, "22, "19.
8325	1.483	.490	.742	27,180	38,630	47,910	64,570	.....	.....	.....	.....	do .....	.....
8326	1.484	.492	.750	26,450	35,270	48,020	64,030	.....	.....	.....	.....	do .....	.....
8327	1.494	.493	.737	25,580	34,710	47,210	64,080	.....	.....	.....	.....	do .....	.....
8328	1.485	.499	.746	25,560	34,260	47,140	63,190	.....	.....	.....	.....	do .....	.....
8329	1.301	.763	.993	39,900	40,180	61,680	62,110	.....	.....	.....	.....	do .....	.....
8330	1.308	.760	.993	37,520	37,780	50,310	59,730	.....	.....	.....	.....	do .....	.....
8331	1.254	.760	.853	40,200	42,180	61,850	64,900	.....	.....	.....	.....	do .....	.....
8332	1.256	.761	.856	41,200	48,100	59,110	61,880	.....	.....	.....	.....	do .....	.....



**THE RESISTANCE OF BANDED SHELLS WHEN FORCED
THROUGH THE BORES OF RIFLED GUNS.**



THE RESISTANCE OF BANDED SHELLS WHEN FORCED THROUGH THE BORES OF RIFLED GUNS.

Guns of five different calibers are represented in these tests—3.2-inch B. L. field guns, 5-inch B. L. siege rifle, 7-inch B. L. siege howitzer, 8-inch B. L. seacoast gun, and 10-inch B. L. seacoast gun.

Through the bore of these guns copper banded shells were forced, and the resistance of the shell measured at frequent intervals along the length of travel in the guns.

The 3.2-inch, 5-inch, and 7-inch guns were experimented upon in the testing machine; the two larger caliber guns were experimented with in the arsenal erecting shop.

The resistances in the latter two were ascertained with a pressure gauge attached to hydraulic piping near the powder chamber. A piston with leather packing in the powder chamber afforded the necessary means for forcing the shell along the bore, followers being introduced between the piston and the shell as the stroke of the piston, limited by the powder chamber, was successively exhausted.

The rate of piston speed was .093 foot per minute in the 8-inch gun, and .053 foot per minute in the 10-inch gun, these rates of speed being maintained throughout each of these two experiments.

The guns experimented upon with the testing machine had their shells pushed through the bores by means of a long follower. It was necessary, however, to interrupt the tests after each 24 inches travel, to permit taking a new stroke with the piston of the testing machine.

The rate of travel of the shells ranged from .2 to .4 foot per minute, in some instances exceeding .5 foot per minute.

At the commencement of each test the shells were forced very slowly until the bands were fully engaged in the rifling. During the remainder of each test a more rapid travel of the shell was maintained.

A first crest in the resistance was found when the travel of the shell was between the limit of about ".40 to ".70. The second crest occurred when the shell reached about the end of the forcing cone in those guns which had this feature.

In the model of 1890, rifling of increasing twist, a second and higher crest was found at 6 inches travel, and in the Driggs-Schroeder gun the second crest occurred at about the same place, but in the latter gun some of these subsequent waves of increased resistance did not reach so high limits as those first met.

The bore of the gun, model 1885, was not in so smooth condition as the other two guns of the same caliber, and to this cause is attributed the higher resistance of the shells in the bore.

Three blank cartridges, 1 pound mortar powder each, were fired in model 1885 gun, for the purpose of fouling the bore. The resistance of the shell in the test which followed reached the maximum 107,100 total pounds, or 13,317 pounds per square inch on the base of the shell.

After passing the crests of high resistance there was a gradual tendency to decrease the resistance, as the shell traveled along the chase of the guns.

There were instances in which a sharp increase occurred when the band had nearly reached the muzzle of the gun, which was attributed to the point of the shell falling, having passed out of the bore, a wedge action taking place.

The resistance of the band was in some degree dependent upon the manipulation of the testing machine.

Under a fairly uniform rate of speed the resistance of the shell was not subject to wide variations. When the travel of the shell was stopped at the end of each stroke of the piston of the testing machine, the cessation of motion was frequently accompanied by a decided increase in the resistance of the shell.

After the piston had stopped for an interval of several minutes the seemingly reflex action of the copper band continued, and further increased the load which was on the base of the shell.

There was usually a momentary increase in resistance accompanying the beginning of a new stroke of the piston.

In test No. 8357, 7-inch howitzer, the speed of the shell was intentionally varied so as to maintain a resistance of 70,000 pounds for a time, and then by a slow piston movement the resistance was maintained at 60,000 pounds.

Experiments were made with special bands on 3.2-inch shell, which were forced through the Driggs-Schroeder gun.

These bands offered less metal to shear and displace by the lands of the gun than the regular bands, and lower resistances were found in their use.

In the following table are shown the maximum resistance and the distance the shell had traveled at the time, in the different experiments. Where two sets of figures are given, they refer to the two crests of high resistance shown in the same experiment.

Only those experiments are indicated in this table where the regular bands were used.

The pressures per square inch are computed on the nominal diameter of the bore of gun.

3.2-INCH B. L. STEEL FIELD RIFLE. MODEL 1835.

No. of test.	Travel of shell.	Resistance.		Remarks.
		Total.	Per square inch.	
	<i>Inches.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
8393	0.64+	99,200	12,335	} Gun fouled.
8394	.72	72,900	9,064	
8395	.68	72,500	9,015	
8396	.62	70,600	8,779	
	7.00	107,100	13,317	
8399	.45	56,800	7,063	
8400	.54	51,000	6,342	

3.2-INCH DRIGGS-SCHROEDER B. L. STEEL FIELD RIFLE.

8391	{ 0.37	37,000	4,601	
	{ 6.00	26,600	3,308	
8392	{ .43	41,300	5,136	
	{ 6.00	38,300	4,762	
8402	{ .45	38,600	4,800	
	{ 8.00	40,600	5,048	
8403	{ .37	44,200	5,496	
	{ 6.00	40,400	5,203	
8552	{ .41	41,400	5,148	
	{ 10.00	60,000	7,461	

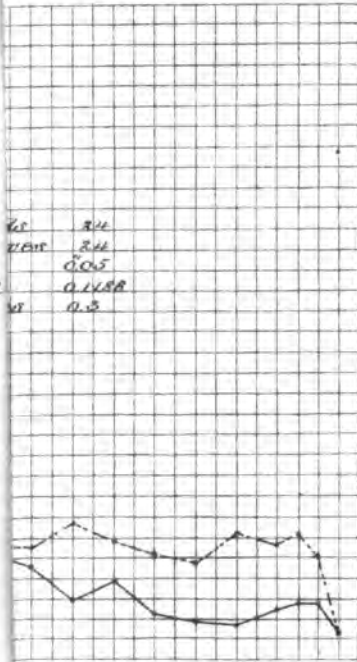
3.2-INCH B. L. STEEL FIELD RIFLE. MODEL 1890.

8628	{ 0.38	45,600	5,670	} Momentary.
	{ 6.00	51,000	6,342	
	{ 9.33+	60,400	7,510	
8629	{ .40	37,100	4,613	
	{ 6.00	44,800	5,571	

ore.

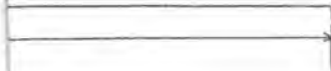
Total load
on shaft.
lbs.

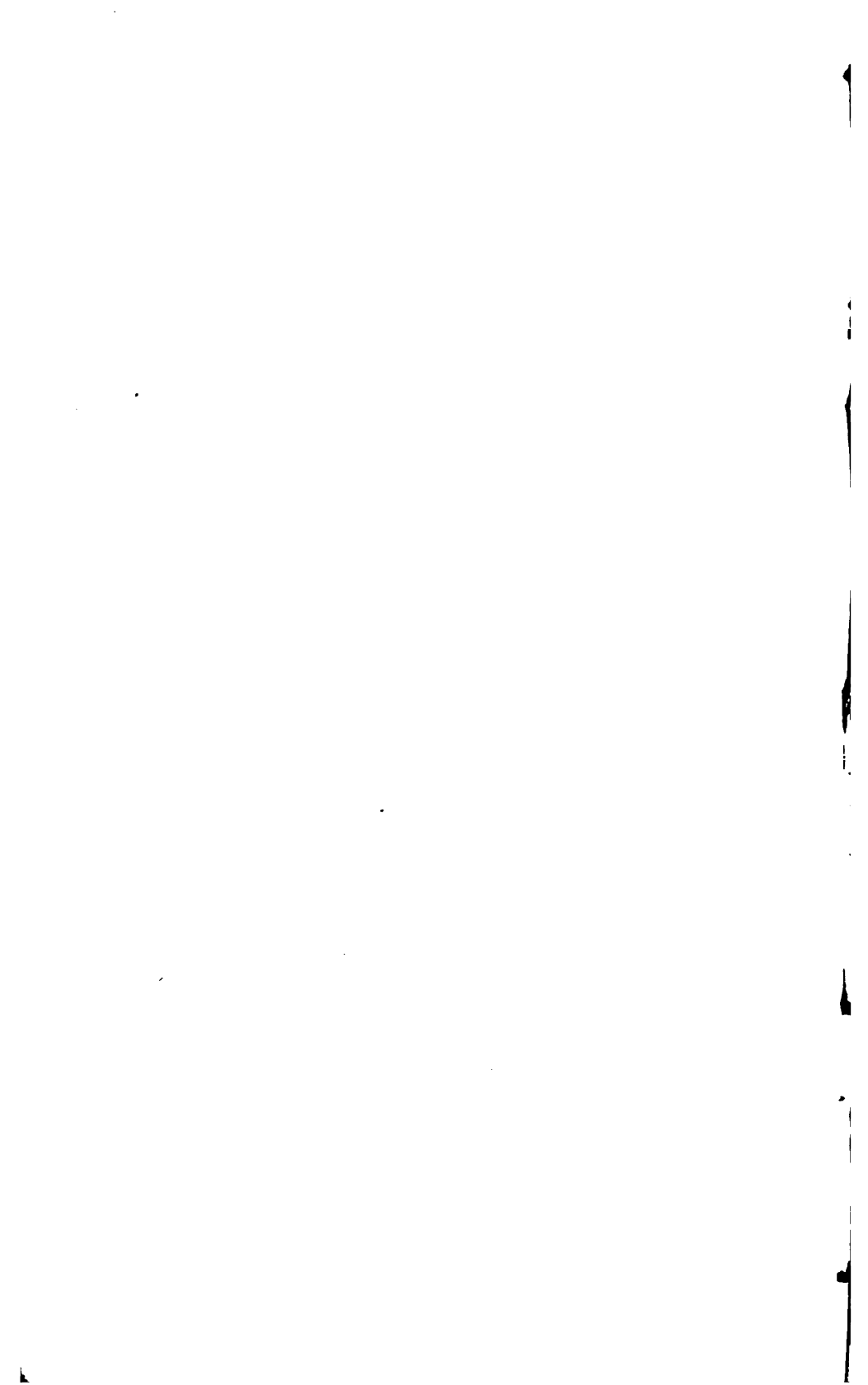
65	2.4
66	2.4
	0.05
	0.1458
68	0.3



a ft. per minute.
0.3 . . .
0.2 . . .
0.1 . . .
0

56 58 60 62 64 66 68 70





5-INCH B. L. STEEL SIEGE RIFLE. MODEL 1890.

8369	{	0.58	89,000	4,523	
		15.50	104,200	5,307	
8370	{	.55	68,500	3,489	
		14.00	103,300	5,261	

7-INCH B. L. STEEL SIEGE HOWITZER. MODEL 1890.

8357	{	0.70	88,600	2,302	
		21.30	85,000	2,209	
8358	{	.60+	100,500	2,611	
		18.87	103,700	2,694	
8361	{	.80	129,000	3,552	
		20.00±	138,000	3,586	

8-INCH B. L. RIFLE, STEEL. MODEL 1888.

8371	{	1.50	243,120	4,837	
		25.50±	188,540	3,751	

10-INCH B. L. RIFLE, STEEL. MODEL 1888, MODIFIED.

8504	{	1.50	312,770	3,982	
		52 to 54	265,200	3,377	

On the diagrams, the full lines represent the curves of resistance, the dotted lines the curves of velocity of the shells.

3.2-INCH B. L. STEEL FIELD RIFLE. MODEL 1885.

No. 8393.

Gun branded at muzzle { "Watervliet Arsenal.
830 lbs. No. 26.
I. M. 1890."

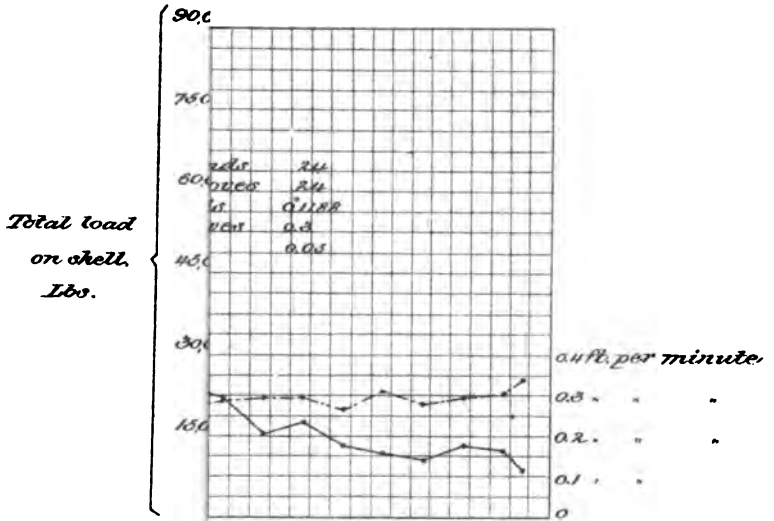
Dimensions of band same as in test No. 8391.
Shell pushed through the gun.
Bore of gun in a thoroughly greased condition.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
1,000	0.	.....	3 34 45	
5,000	.02	.....	35 00	
10,000	.05	.....	35 25	
15,000	.08	.....	35 45	
20,000	.10	.....	36 15	
30,000	.16	.....	36 50	
40,000	.22	.....	37 30	
50,000	.27	.....	38 35	
55,000	.30	.....	39 20	
60,000	.34	.....	40 05	
65,000	.38	.....	40 45	
70,000	.39	.....	41 40	
75,000	.42	.....	42 20	
80,000	.46	.....	3 43 00	
90,000	.54	.....	44 15	
95,300	.62	.....	45 10	
98,300	.64	0.005	45 45	

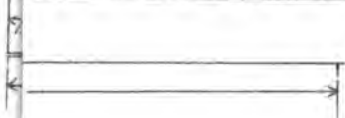
No. 8393—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	Inches.	Foot.	h. m. s.	
99, 200				Throb, and load fell. Then followed a series of throbs, the load fluctuating between 70,000 and 85,000 pounds.
72, 000	.97	.009	3 48 00	Test interrupted to recenter follower.
74, 000			3 56 00	Test resumed.
57, 000			57 00	Throb; load fell.
62, 000	1.00			Throb.
58, 400	1.02			
50, 000	1.90	.022	3 59 30	
47, 200	2.45	.092	4 00 00	
45, 600	3.00	.153	00 18	
44, 500	4.00	.208	00 42	
42, 800	5.00	.152	01 15	
40, 200	6.00	.152	01 48	
36, 200	8.00	.154	02 53	
36, 500	10.00	.149	04 00	
			4 08 15	Follower again recentered.
32, 000				Test resumed.
34, 000	11.00	.091	4 09 10	Throb.
35, 000	12.00	.227	09 32	
34, 000	14.00	.208	10 20	
30, 600	16.00	.200	11 10	
28, 800	18.00	.250	11 50	
29, 200	20.00	.227	12 34	
28, 100	22.00	.182	13 29	
	23.00	.172	13 58	
29, 000			4 22 50	New stroke of piston.
27, 200	24.00			Test resumed.
23, 100	25.00	.179	23 40	
22, 600	27.00	.263	24 48	
24, 200	28.00	.238	25 28	
24, 200	31.00	.278	26 04	
23, 100	33.00	.333	26 34	
21, 000	35.00	.323	27 05	Throbs nearly ceased.
19, 800	37.00	.370	27 32	
21, 500	39.00	.333	28 02	
22, 500	41.00	.357	28 30	
22, 400	43.00	.357	28 58	
22, 600	45.00	.333	29 28	
22, 100	46.00	.333	29 43	
			4 38 10	New stroke of piston.
26, 000				Test resumed.
19, 900	47.00		4 39 30	Maximum momentary resistance.
21, 600	48.00	.227	39 52	
17, 800	50.00	.250	40 32	
19, 200	52.00	.270	41 09	
19, 700	54.00	.278	41 45	
17, 600	56.00	.270	42 22	
11, 200	58.00	.333	43 02	
14, 800	60.00	.294	43 36	
8, 600	62.00	.263	44 14	
7, 100	64.00	.238	44 56	
6, 300	66.00	.313	45 28	
9, 300	68.00	.278	46 04	
10, 600	69.00	.313	46 20	
10, 600	70.00	.250	46 40	
			4 51 20	New stroke of piston.
12, 200				Test resumed.
4, 100	71.00	.077	4 52 25	Maximum momentary resistance.

Diameter of band after the test { Over lands in the copper, 3'' .32.
 { Over grooves in the copper, 3'' .21.



56 58 60 62 64 66 68 70





No. 8394.

Bore of gun washed with soda water and a new shell pushed through. Dimensions of band same as in test No. 8391.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	Inches.	Foot.	h. m. s.	
1,000	0.	-----	9 05 10	
5,000	.02	-----		
10,000	.06	-----	05 45	
15,000	.09	-----		
20,000	.12	-----	06 45	
30,000	.18	-----		
40,000	.26	-----		
50,000	.35	-----	08 50	
55,000	.40	-----		
60,000	.44	-----	10 35	
65,000	.48	-----		
70,000	.58	-----	12 25	
72,900	.72	0.008	13 00	
67,000	.96	-----	13 45	
62,000	1.11	-----	14 12	
60,000	1.34	-----	14 32	
58,200	1.66	-----	15 18	
56,000	2.00	.037	15 52	
56,600	2.90	-----		
52,000	3.00	.046	9 17 40	
44,000	4.00	.059	19 05	Increasing the speed appeared to lower the resistance.
38,500	6.00	.143	9 20 15	Load gradually increased.
51,000	-----	-----	-----	A throb occurred, the load falling to 29,500.
29,500	6.87	-----	-----	Load gradually brought up to 45,000.
45,000	-----	-----	-----	Speed now suddenly increased.
38,000	-----	-----	-----	Resistance while under rapid movement of the shell.
43,000	7.10	-----	9 31 30	
38,400	8.00	.014	32 00	
40,800	10.00	.154	33 05	
40,200	12.00	.256	33 44	
40,500	14.00	.278	34 20	
37,700	16.00	.322	35 05	
34,000	18.00	.370	35 32	
35,300	20.00	.317	36 18	
35,800	22.00	.250	36 58	
35,900	24.00	.256	37 37	
-----	-----	-----	10 10 45	New stroke of piston. Test resumed.
46,000	-----	-----	-----	Momentary resistance followed by sudden throb.
24,000	-----	-----	-----	Load after throb.
30,600	25.00	.030	10 13 30	
31,100	26.00	.250	13 50	
31,400	28.00	.250	14 30	
31,800	30.00	.263	15 08	
29,300	32.00	.233	16 49	Brief interruption in test.
29,200	34.00		17 32	
27,300	36.00	.250	18 12	
26,000	38.00	.256	18 51	
28,900	40.00	.256	19 30	
29,200	42.00	.286	20 05	
28,800	44.00	.303	20 38	
28,200	46.00	.313	21 10	
26,500	47.00	.263	21 29	
28,000	47.68	-----	-----	
-----	-----	-----	10 31 00	New stroke of piston. Test resumed.
30,000	-----	-----	81 20	Momentary resistance.
24,300	48.68	.066	31 58	
22,400	49.68	.238	32 19	
24,200	51.68	.233	33 02	
24,400	53.68	.270	33 39	
22,300	55.68	.286	34 14	
15,300	57.68	.294	34 48	
18,200	59.68	.294	35 22	
13,300	61.68	.263	36 00	
11,500	63.68	.313	36 32	
10,600	65.68	.278	37 08	
13,300	67.68	.294	37 42	
12,200	69.68	.303	38 15	
9,200	70.68	.333	38 30	

No. 8395.

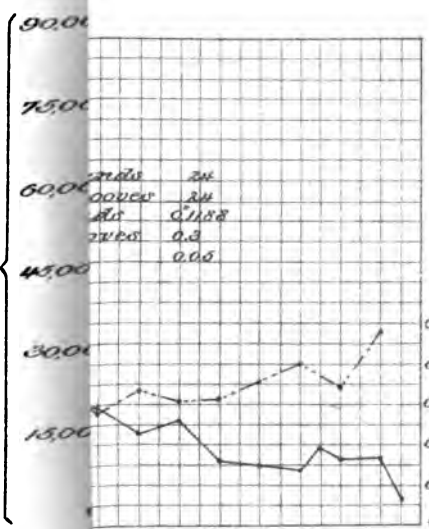
Bore of gun well lubricated with heavy cylinder oil, and a new shell pushed through the gun.

Dimensions of band same as in previous tests.

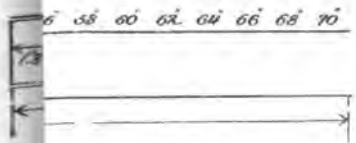
Resistance.		Distance shell traveled.	Velocity per minute.	Time of observations.		Remarks.
Pounds.	Inches.	Foot.	h.	m.	s.	
2,400	0.	0.	2	18	30	
5,000	.01	.....			
10,000	.02	.....		19	20	
15,000	.06	.....			
20,000	.11	.....			
30,000	.19	.....		20	35	
40,000	.26	.....			
50,000	.34	.....		22	20	
55,000	.48	.....			
60,000	.41	.....		24	20	
65,000	.45	.....			
70,000	.53	.....		25	50	
72,200	.61	.....		26	20	
72,500	.68	.006		26	45	
70,000	.80	.....		27	15	
67,000	.92	.....		27	35	
64,800	1.00	.023		27	55	
62,000	1.20	.....	2	28	30	
60,000	1.42	.....		29	10	
58,000	1.69	.....		30	00	
52,400	2.00	.032		30	30	
38,500	4.00	.161		31	32	
38,900	6.00	.208		32	20	
40,200	8.00	.222		33	05	
41,500	10.00	.333		33	35	
40,500	12.00	.200		34	25	
38,900	14.00	.233		35	08	
36,400	16.00	.270		35	45	
34,100	18.00	.233		36	28	
35,500	20.00	.238		37	10	
34,900	22.00	.263		37	48	
36,100	23.00	.250		38	08	
36,200	24.00	.250		38	28	
			2	48	00	New stroke of piston. Test resumed.
41,700				48	40	Momentary resistance. Throb.
44,900						
33,100	25.00	.040	2	50	05	
31,800	26.00	.250		50	25	
31,400	28.00	.333		50	55	
31,700	30.00	.286		51	30	
28,900	32.00	.333		52	00	
27,800	34.00	.313		52	32	
26,300	36.00	.313		53	04	
25,100	38.00	.333		53	34	
27,900	40.00	.294	2	54	08	
27,800	42.00	.323		54	39	
26,900	44.00	.303		55	12	
26,900	46.00	.313		55	44	
25,000	48.00	.294		56	18	
			3	04	30	New stroke of piston. Test resumed.
28,700				05	15	
25,100	49.00	.048		06	15	
23,200	50.00	.217		06	38	
24,100	52.00	.294		07	12	
23,500	54.00	.370		07	39	
22,200	56.00	.278		08	15	
16,900	58.00	.333		08	45	
19,200	60.00	.303		09	18	
12,000	62.00	.313		09	50	
11,200	64.00	.357		10	18	
10,200	66.00	.400		10	43	
14,300						
12,200	68.00	.345		11	12	
12,600	70.00	.476		11	33	
5,000	71.00	.....			

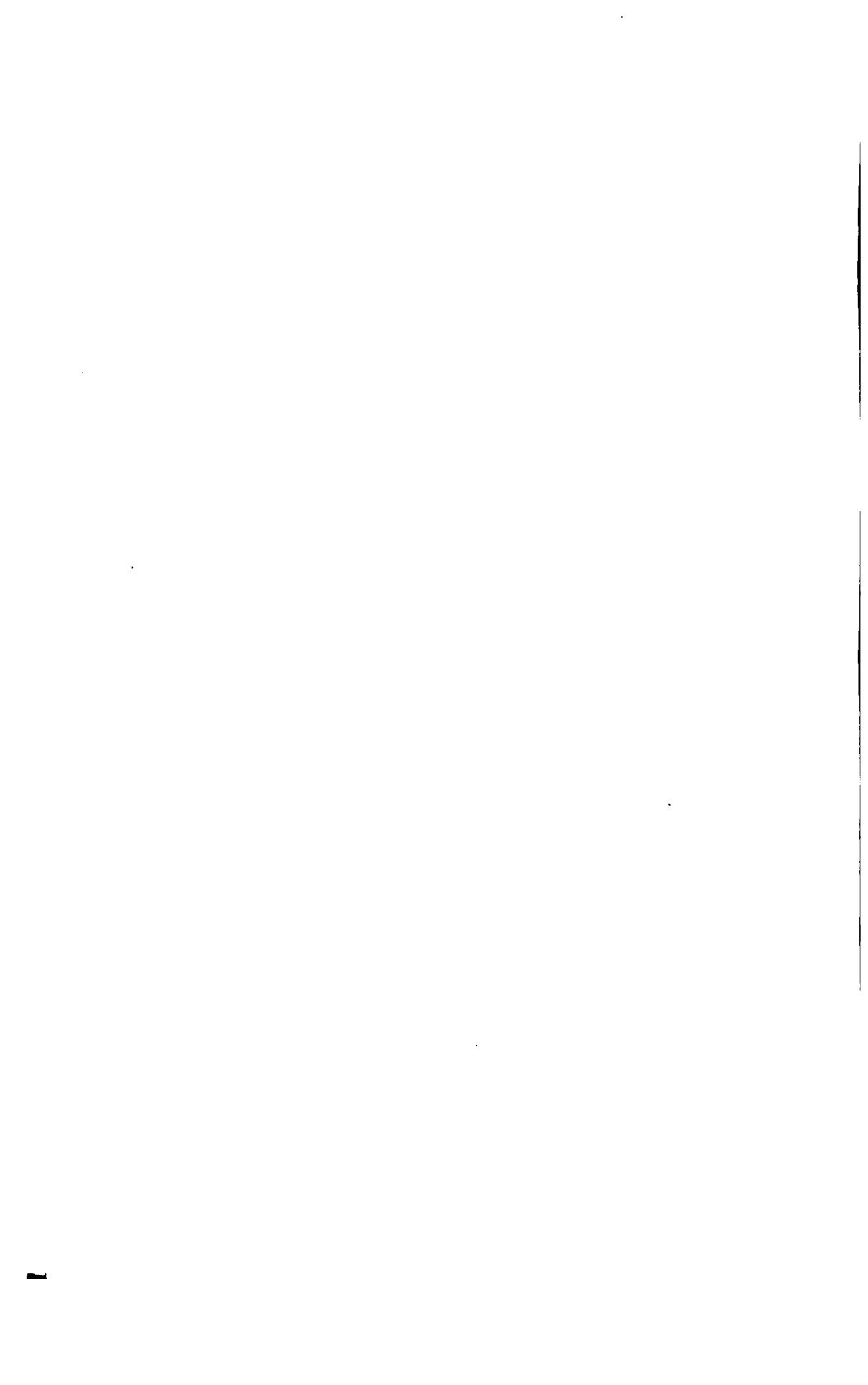
778.

Total load
on shell.
lbs.



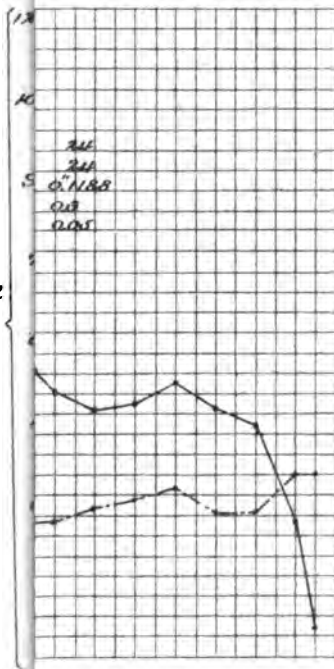
778
00000
00000
00000
00000
00000





st began.

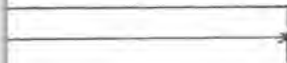
Total load
on shell,
Ibs.

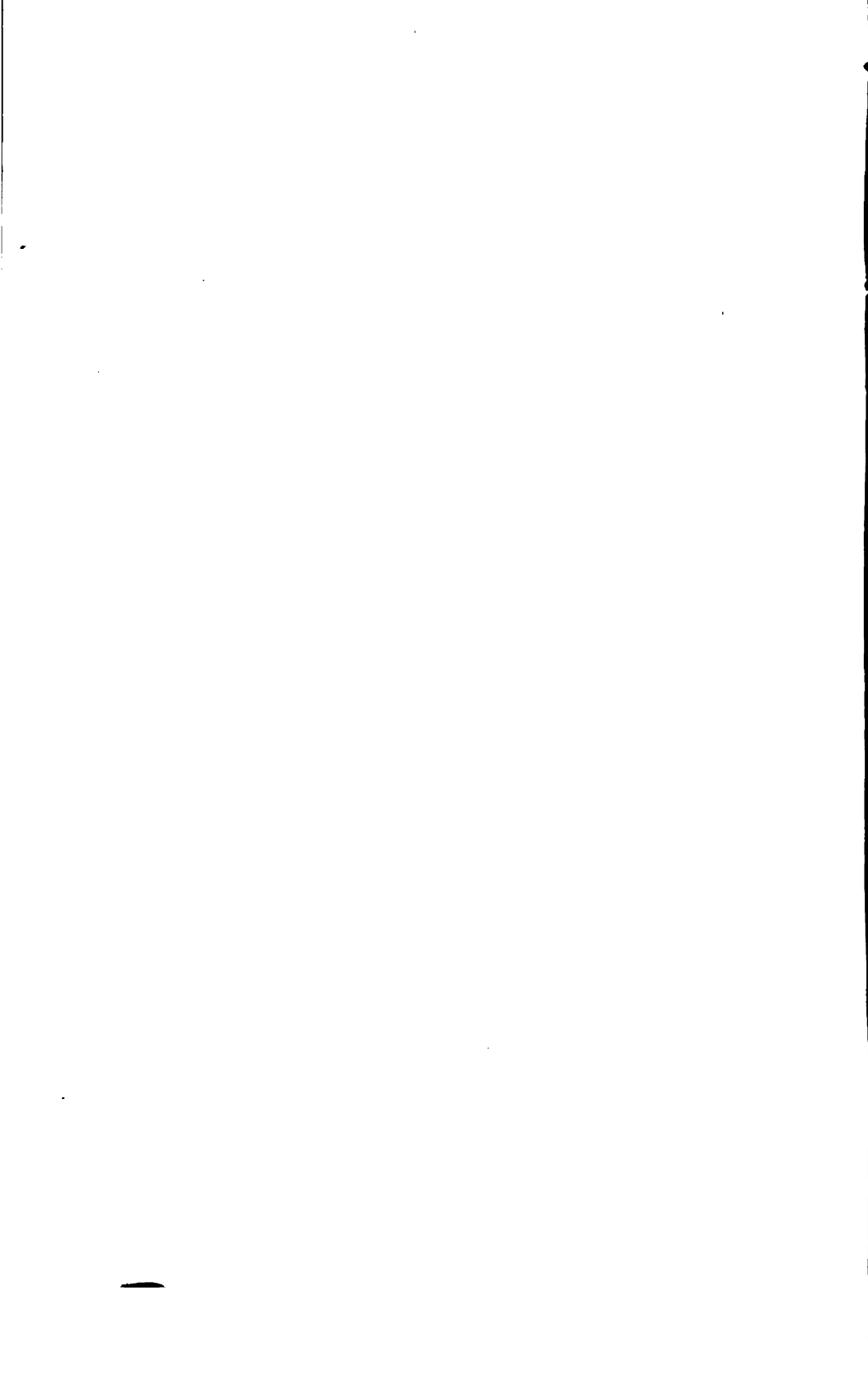


04 ft. per minute

0.0 . . .
0.2 . . .
0.1 . . .
0

58 60 62 64 66 68 70





No. 8396.

Bore of gun fouled by means of three rounds with blank cartridges of 1 pound of powder each, fired immediately before testing.

New shell pushed through the gun having the same dimensions of band as in the previous tests.

Test began about ten minutes after firing the third round.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
7,800	0.	0.	4 04 50	
15,000	.03			
20,000	.07			
30,000	.13		05 55	
40,000	.22			
50,000	.30			
60,000	.37		07 55	
70,000	.53			
70,600	.62			
68,000	.77		08 35	
66,700	1.00	.019	09 10	
76,100	2.00	.083	10 10	
82,700	3.00	.143	10 45	
92,300	4.00	.200	11 10	
97,700	5.00	.200	4 11 35	
101,700	6.00	.217	11 58	
107,100	7.00	.294	12 15	
99,800	8.00	.167	12 45	
96,300	10.00	.200	13 35	
98,200	12.00	.250	14 15	
92,800	14.00	.303	14 48	
97,600	16.00	.333	15 18	
79,600	18.00	.238	16 00	
78,200	20.00	.313	16 32	
73,800	22.00	.303	17 05	
72,200	24.00	.308	17 38	
			4 24 59	New stroke of piston. Test resumed.
73,200				
71,000	25.00	.052	26 35	
63,500	26.00	.250	26 55	
56,200	28.00	.233	27 38	
56,400	30.00	.313	28 10	
54,200	32.00	.333	28 40	
53,400	34.00	.383	29 10	
53,500	36.00	.333	29 40	
49,900	38.00	.333	30 10	
51,900	40.00	.313	30 42	
49,400	42.00	.357	31 10	
48,900	44.00	.286	31 45	
50,500	46.00	.333	32 15	
51,100	48.00	.303	4 32 48	
			4 40 40	New stroke of piston. Test resumed.
49,000				
50,600	49.00	.083	41 40	
46,400	50.00	.200	42 05	
44,900	52.00	.283	42 43	
46,800	54.00	.333	43 13	
42,000	56.00	.333	43 43	
53,000				
49,000	58.00	.333	44 15	
45,900	60.00	.370	44 32	
47,000	62.00	.385	45 08	
50,200	64.00	.417	45 32	
46,200	66.00	.357	46 00	
43,200	68.00	.357	46 28	
25,100	70.00	.455	4 46 50	
5,000	71.00			

The residue of the powder accumulated in front of the band on the shell, and when the latter reached the muzzle of the gun the residue filled the space between the shell and the gun, covering about $1\frac{1}{8}$ " in length along the shell.

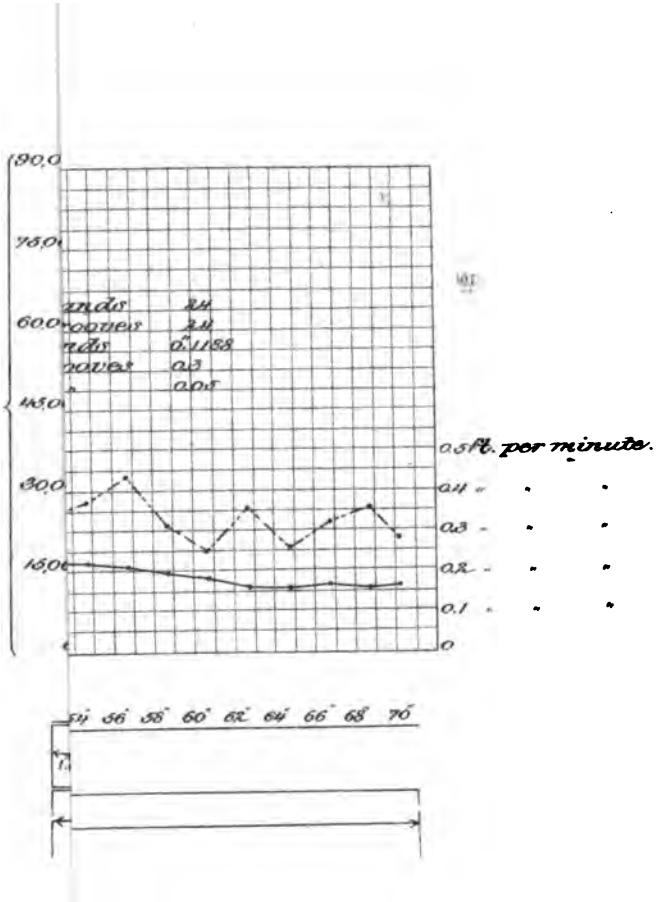
No. 8399.

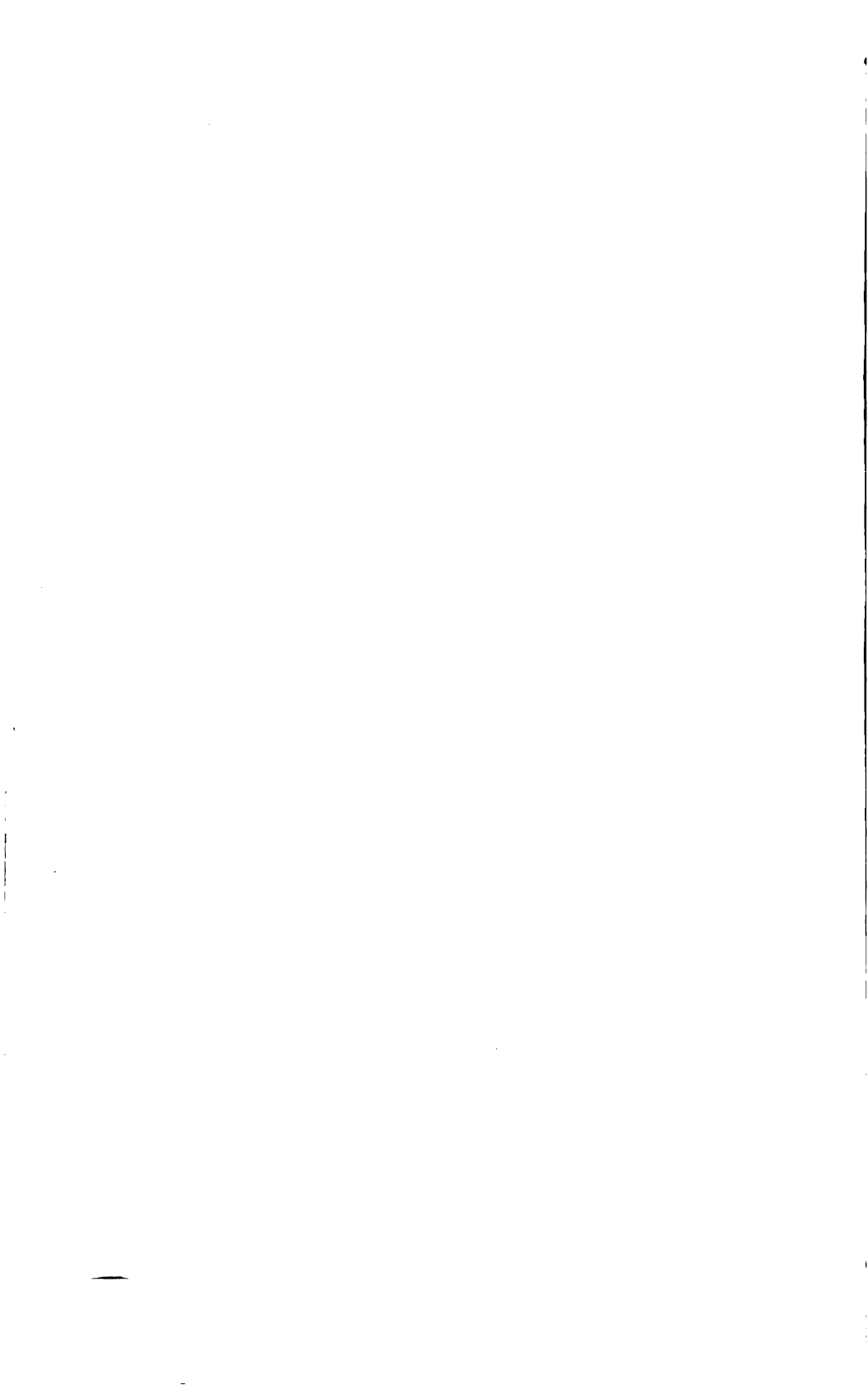
A new shell with band of same dimensions as in previous tests pushed through the gun by means of follower mounted on the anti-friction nut.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
			h.	m.	s.	
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	10	27	20	
1,000	0.	0.				
10,000	.03					
20,000	.08					
30,000	.14			28	05	
40,000	.22					
50,000	.32					
55,000	.39					
56,800	.45	.016		29	40	
55,000	.53			30	04	
45,000	.78			30	32	
38,400	1.00	.037		30	55	
33,000	2.00	.111		31	40	
27,800	4.00	.192		32	32	
29,000	6.00	.263		33	10	
25,900	8.00	.263		33	48	
25,600	10.00	.333		34	18	
24,200	12.00	.345		34	47	
21,500	14.00	.323	10	35	18	
21,100	16.00	.370		35	45	
19,800	18.00	.332		36	15	
19, J	20.00	.417		36	39	
18,600	22.00	.345		37	08	
18,200	23.00	.500		37	18	
18,100	23.58	.242		37	30	
			11	00	20	New stroke of piston. Test resumed.
23,400						
19,100	24.58	.051		01	58	
19,200	25.58	.250		02	18	
18,200	27.58	.313		02	50	
17,900	29.58	.333		03	20	
16,100	31.58	.400		03	45	
16,400	33.58	.370		04	12	
16,500	35.58	.357		04	40	
14,600	37.58	.357		05	08	
15,000	39.58	.357		05	36	
15,400	41.58	.417		06	00	
15,500	43.58	.357		06	28	
16,100	45.58	.385		06	54	
16,100	46.76	.369		07	10	
			11	25	00	New stroke of piston. Test resumed.
19,200						
15,300	47.76	.071		26	10	
16,400	48.76	.200	11	26	35	
17,300	50.76	.233		27	18	
17,100	52.76	.333		27	48	
16,500	54.76	.370		28	15	
15,400	56.76	.435		28	38	
14,500	58.76	.313		29	10	
						Test interrupted.
13,500	60.76	.250		29	50	
12,000	62.76	.357		30	18	Test interrupted.
			11	35	00	Test resumed.
11,700	64.76	.256		35	39	
12,200	66.76	.323		36	10	
11,500	68.76	.357		36	38	
11,400	70.26	.278		37	05	
			11	45	15	New stroke of piston. Test resumed.
11,800	70.28					

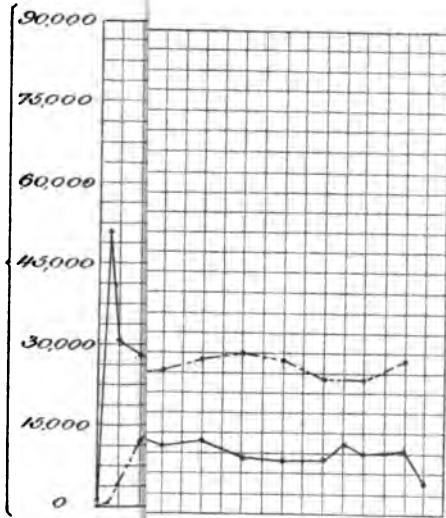
bore.

*Total load
on shell:
Lbs.*





Total load
on shell.
Lbs.



ft. per minute.

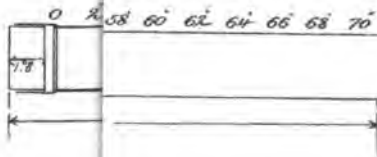
0.4 . . . "

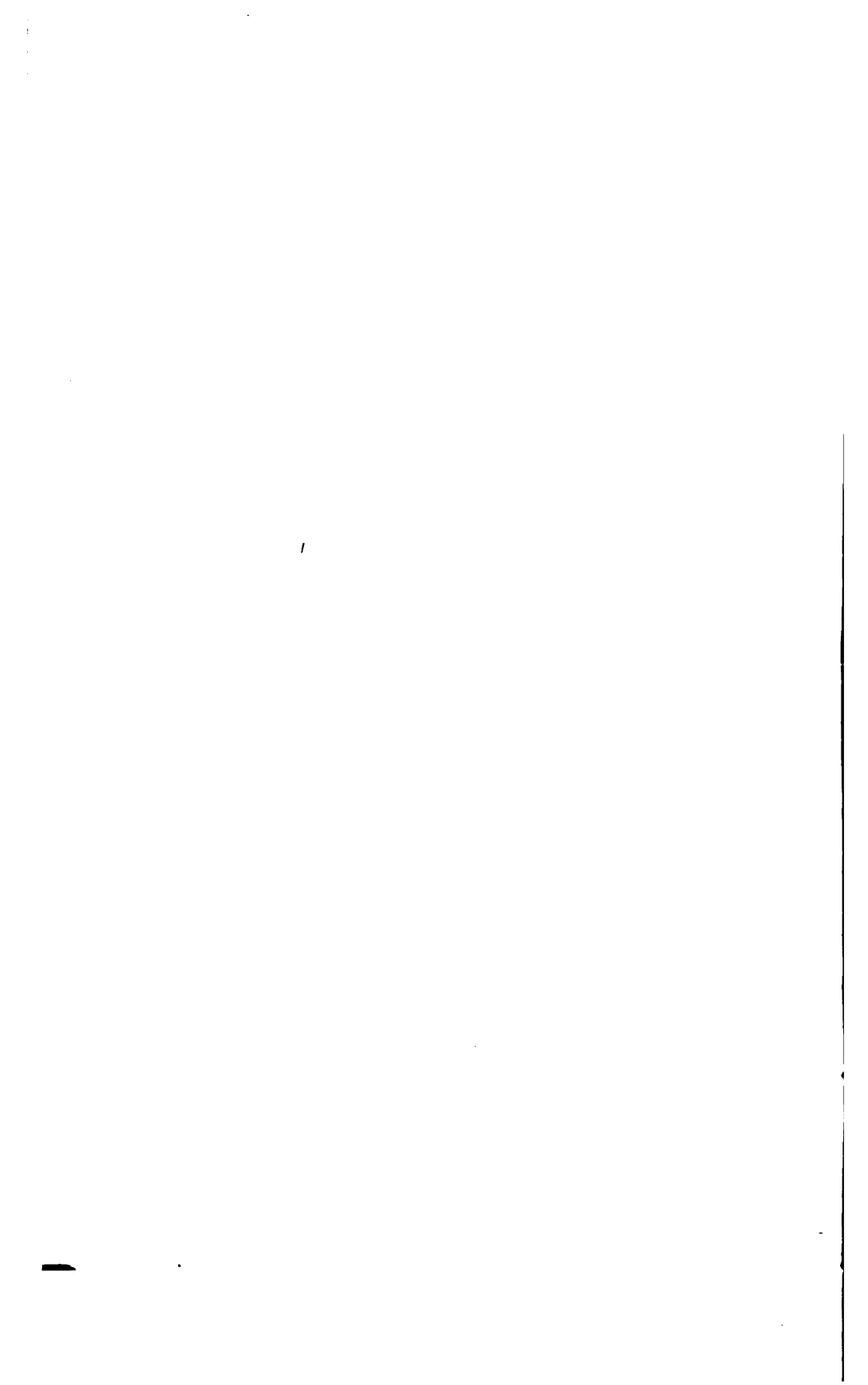
0.3 . . . "

0.2 . . . "

0.1 . . . "

0





No. 8400.

Condition of test same as No. 8399 excepting the follower is gripped in the holder jaws, the antifricition nut not being used.

Bore of gun lubricated with heavy cylinder oil.

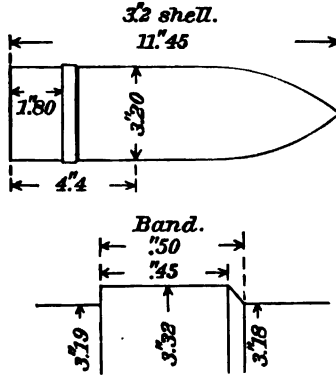
Shell pushed through the gun. Dimensions of band same as in previous tests.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
1,000	0.	0.	1 39 10	
10,000	.04			
20,000	.13			
30,000	.23			
40,000	.35		41 00	
50,000	.48			
51,000	.54	.014	42 20	
36,000	.90			
31,000	1.00	.057	43 00	
28,200	2.00	.167	43 30	
25,000	4.00	.263	44 08	
26,100	6.00	.333	44 38	
24,600	8.00	.313	45 10	
24,400	10.00	.111	1 46 40	Test interrupted.
23,600	12.00	.357	47 08	
22,300	14.00	.400	47 33	
22,100	16.00	.370	48 00	
20,600	18.00	.385	48 26	
21,000	20.00	.385	48 52	
21,100	22.00	.435	49 15	
21,000	24.00	.370	49 42	
			2 07 30	New stroke of piston. Test resumed.
30,400				
30,300	25.00	.091	08 25	
19,500	26.00	.294	08 42	
19,400	28.00	.278	09 18	
19,700	30.00	.345	09 47	
17,600	32.00	.357	10 15	
17,300	34.00	.333	10 45	
16,100	36.00	.370	11 12	
14,800	38.00	.333	11 42	
16,500	40.00	.385	12 08	
16,100	42.00	.333	12 38	
16,500	44.00	.250	13 18	
15,700	46.00	.238	14 00	
15,000	48.00	.208	14 48	Test interrupted.
			2 30 00	New stroke of piston. Test resumed.
21,000				
16,200	49.00	.077	2 31 05	
15,800	50.00	.500	31 15	
16,200	52.00	.333	31 45	
16,300	54.00	.303	32 18	
15,300	56.00	.345	32 47	
12,700	58.00	.357	33 15	
13,700	60.00	.385	33 41	
10,800	62.00	.460	34 06	
10,100	64.00	.385	34 32	
10,200	66.00	.333	35 02	
13,400				
11,200	68.00	.333	35 32	
11,400	70.00	.385	35 58	
6,000	71.00			

3.2-INCH DRIGGS-SCHROEDER B. L. STEEL FIELD RIFLE.

No. 8391.

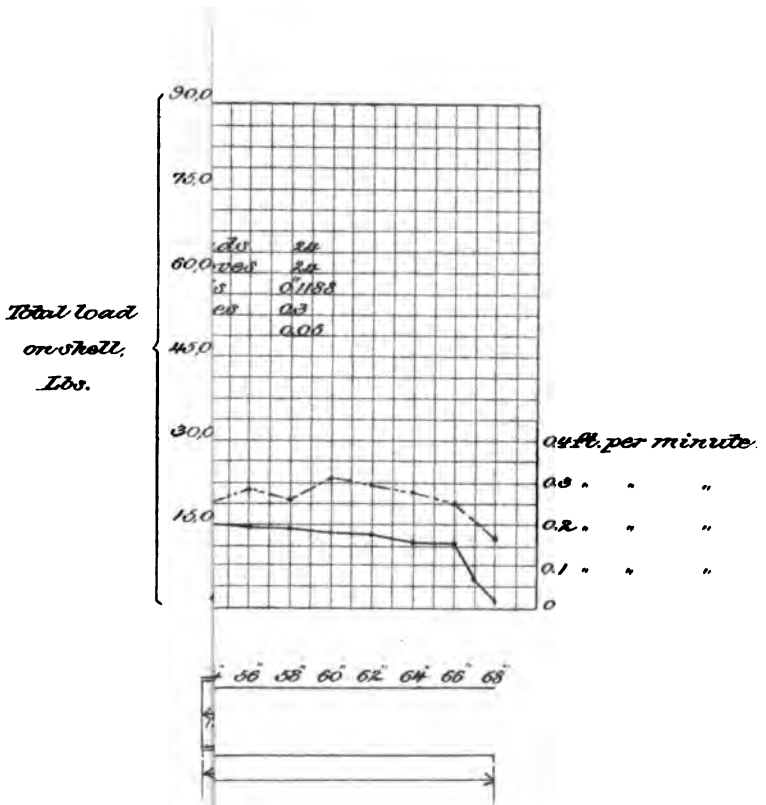
Gun branded at muzzle { "Watervliet Arsenal.
815 lbs. No. 1.
D. A. H. 1892."



Shell pushed through the gun. The bore of the gun was in a thoroughly greased condition when this shell was forced through.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	Inches.	Foot.	h. m. s.	
1,000	0.	9 03 20	Initial load..
20,000	.04	.....	04 00
25,000	.09	.....	04 20
25,500	.13	.....	05 10
30,000	.19	.....	05 40
37,000	.37	0.010	06 20	
20,000	.60	.....	06 40
17,500	.85	.....	07 30
16,500	1.14	.030	08 30	
18,200	1.30	.....	09 25
20,000	1.54	.....	10 05
22,400	2.00	.083	10 40	
24,000	3.00	.077	11 45	
25,400	4.00	.....	9 12 30
26,200	5.00	.....	13 10
26,600	6.00	.130	13 40	
25,200	7.00	.....	14 20
24,200	8.00	.....	15 00
23,850	9.00	.180	15 35	
24,600	10.00	.111	16 20	
24,100	11.00	.111	17 05	
22,300	12.00	.....	17 50
21,900	13.00	.....	18 35
21,100	14.00	.097	19 40	
20,400	15.00	.100	20 30	
21,000	16.00	.100	21 20	
19,400	18.00	.333	22 50	
18,300	20.00	.100	24 30	
17,500	22.00	.110	26 00	
17,500	23.00	.100	26 50	
	23.00	9 40 00	New stroke of piston.
20,800	24.00	.071	41 10	
20,100	25.00	.167	41 40	
19,600	27.00	.250	42 20	
20,500	29.00	.250	43 00	
20,100	31.00	.333	43 30	

bore.





No. 8391—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
20,000	33.00	.333	44 00	
19,100	35.00	.313	44 32	
17,900	37.00	.278	45 08	
16,200	39.00	.370	9 45 35	
16,100	41.00	.270	46 12	
15,700	43.00	.333	46 42	
16,000	45.00	.333	47 12	
16,300	46.00	.313	47 28	
	46.00		9 58 00	New stroke of piston.
15,680	47.00	.143	58 35	
15,400	49.00	.189	59 28	
15,300	50.00	.227	59 50	
15,800	52.00	.296	10 00 25	
15,100	54.00	.250	01 05	
14,400	56.00	.286	01 40	
14,300	58.00	.263	02 18	
13,800	60.00	.313	02 50	
13,500	62.00	.294	03 24	
12,000	64.00	.278	04 00	
12,000	66.00	.250	04 40	
5,000	67.00			
1,000	68.00	.167	10 05 40	

Maximum diameter of band after the test, 3".32.

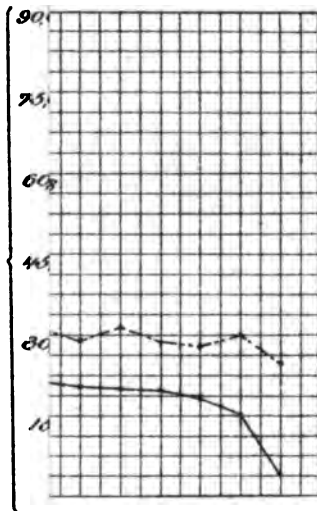
No. 8392.

Bore of gun washed with soda water and a new shell pushed through.
Dimensions of band same as in test No. 8391.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
1,000	0.		11 33 00	Initial load.
10,000	.05	-----	33 20	
20,000	.11	-----	34 10	
23,000	.14	-----	35 20	
28,000	.22	-----	36 20	
35,000	.32	-----	37 20	
40,000	.38	-----	38 25	
41,300	.43	0.006	39 08	
37,500	.49	-----	39 55	
34,000	.55	-----	40 18	
28,000	.63	-----	40 55	
25,000	.76	-----	41 30	
23,800	1.00	.018	41 50	
28,500	2.00	.125	42 30	
32,600	3.00	.143	43 05	
35,400	4.00	.185	43 32	
37,400	5.00	.132	44 10	
38,200	6.00	.167	44 40	
36,200	8.00	.161	45 42	
31,600	10.00	.173	46 40	
30,100	12.00	.173	11 47 38	
26,900	14.00	.125	48 58	
25,000	16.00	.250	49 38	
23,600	18.00	.250	50 18	
23,200	20.00	.238	51 00	
23,500	22.00	.294	51 34	
23,000	23.00	.238	51 55	
			1 06 00	New stroke of piston.
27,000				Momentary maximum resistance.
22,500	23.19	.024	06 40	
25,000	24.00	.101	07 20	
25,400	25.00	.227	07 42	
24,500	27.00	.263	08 20	
23,800	29.00	.333	08 50	
25,700	31.00	.357	09 18	
26,300	33.00	.313	09 50	
28,600	35.00	.345	10 19	
27,500	37.00	.313	10 51	
27,300	39.00	.333	11 21	
27,300	41.00	.323	11 52	
26,600	43.00	.333	12 22	
28,600	45.00	.333	12 52	
27,100	46.00	.313	13 08	
			1 20 20	New stroke of piston.
31,000	46.05	.007	1 20 55	Momentary maximum resistance.
26,200	47.00	.158	21 25	
26,700	48.00	.294	21 42	
25,300	50.00	.313	22 14	
24,900	52.00	.385	22 40	
24,000	54.00	.357	23 08	
21,500	56.00	.417	23 32	
20,600	58.00	.385	23 58	
20,000	60.00	.417	24 22	
19,600	62.00	.385	24 48	
18,500	64.00	.370	25 15	
15,200	66.00	.400	25 40	
4,000	68.00	.333	1 26 10	

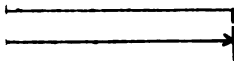
Maximum diameter of band at bottom of grooves after the test, 3".22.

Total load
on shell.
Lbs.



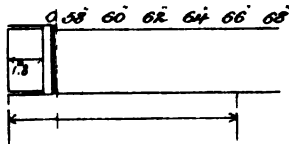
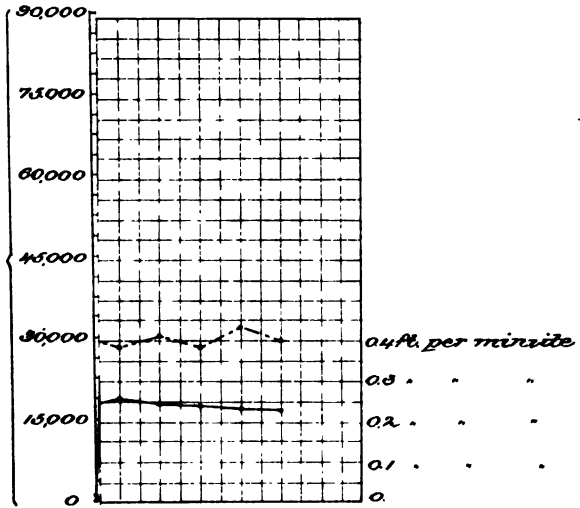
appl. per minute.
 a3 . . .
 a2 . . .
 a1 . . .
 0

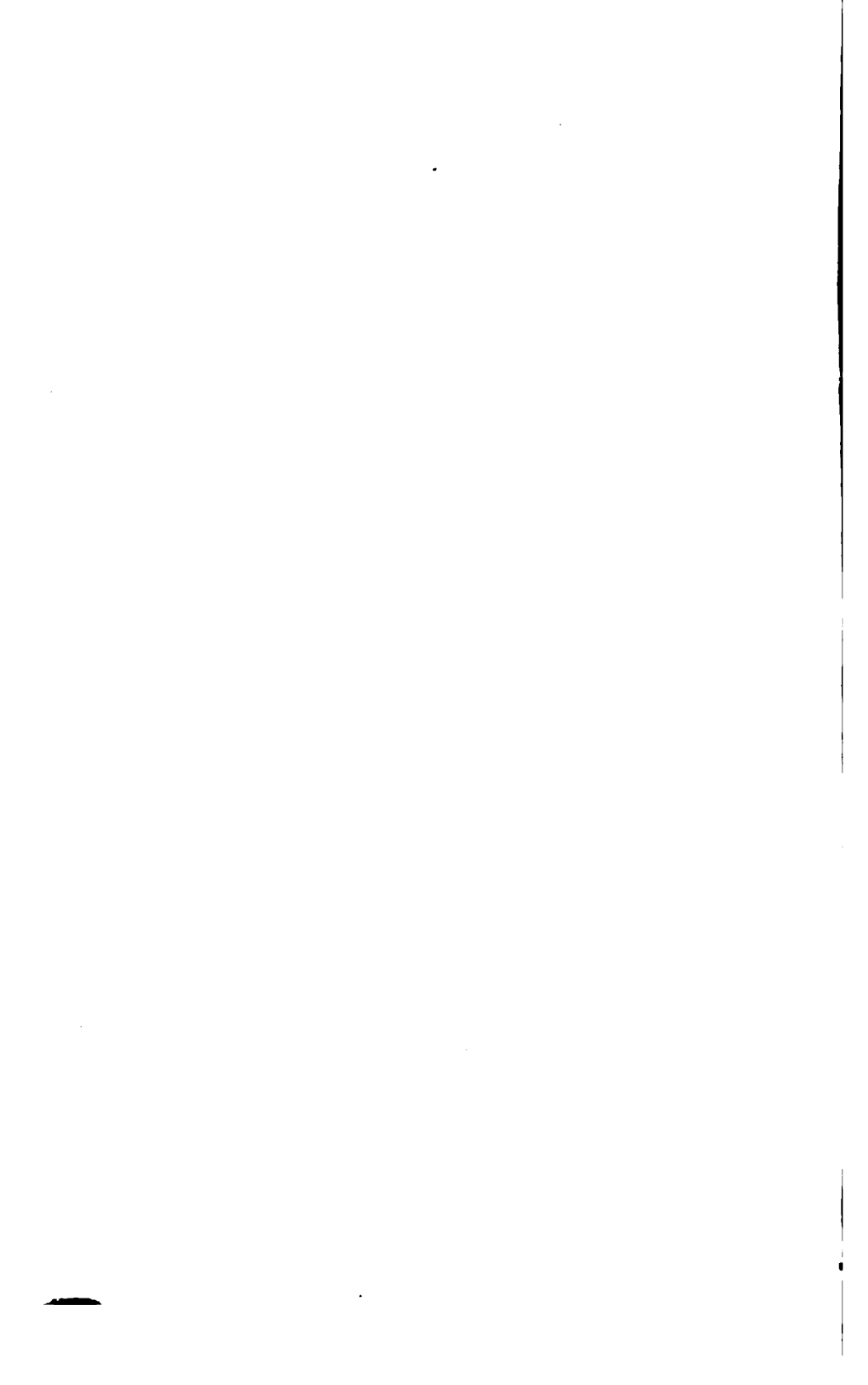
55 60 65 70 75 80





Total load
on shell.
Lbs.





No. 8402.

Bore lubricated with heavy cylinder oil.
 Follower gripped in the holder jaws.
 Dimensions of band same as in previous tests.

Resistance.		Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
Pounds.	Inches.	Foot.	h.	m.	s.		
1,000	0	0		3	45	10	Initial load.
10,000	.03						
20,000	.11						
30,000	.24			3	46	40	
35,000	.45	.020		3	47	12	
32,000	.65	.025			47	32	
25,000	1.00	.076			47	55	
27,000	2.00	.135			48	32	
35,000	3.00						
34,000	4.00	.233		49	15		
35,000	6.00	.338		49	45		
40,000	8.00	.333		50	15		
40,000	10.00	.294		50	49		
30,000	12.00	.385		51	15		
30,500	14.00	.333		51	45		
30,000	18.00	.370		52	12		
30,700	18.00	.357		52	40		
35,100	20.00	.333	3	53	10		
35,000	22.00	.333		53	40		
35,100	24.00	.400		54	05		

35,000			4	11	30		New stroke of piston. Test resumed.
31,000	25.00	.125	4	12	10		
30,200	26.00	.278		12	28		
30,000	28.00	.278		13	04		
32,100	30.00	.335		13	30		
31,000	32.00	.385		13	56		
30,200	34.00	.385		14	22		
27,000	36.00	.357		14	50		
26,000	38.00	.400		15	15		
25,000	40.00	.370		15	42		
21,000	42.00	.385		16	08		
21,500	44.00	.385		16	34		
21,200	46.00	.385		17	00		
20,000	48.00	.400		17	25		

22,000			4	28	10		New stroke of piston. Test resumed.
19,500	49.00	.200	4	28	35		
20,700	50.00	.338		28	50		
21,700	52.00	.357		29	18		
19,000	54.00	.417		29	42		
17,000	56.00	.417		30	06		
19,400	58.00	.385	4	30	32		
18,500	60.00	.417		30	56		
18,200	62.00	.385		31	22		
17,500	64.00	.435		31	45		
17,200	66.00	.400		32	10		

No. 8403.

Bore lubricated with heavy cylinder oil.

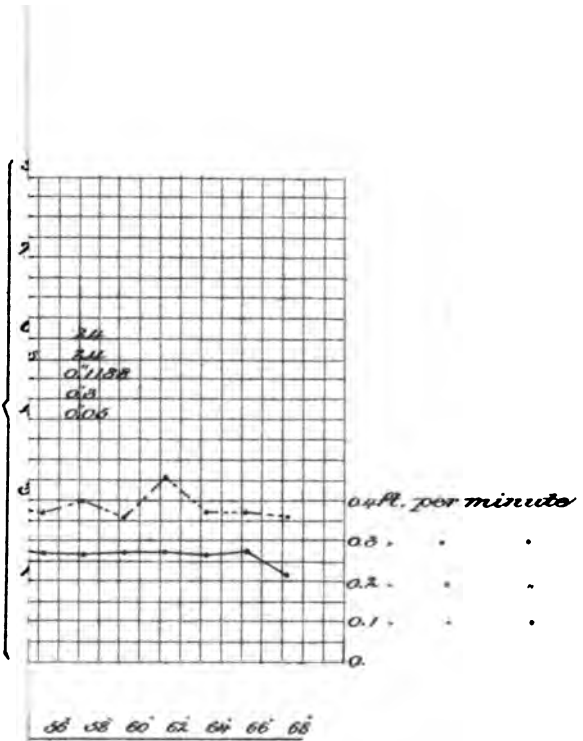
Follower attached to antifriction nut, and shell pushed through the gun.

Dimensions of band same as in previous tests.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
1,000	0.	0.	9 55 00	Initial load.
10,000	.03	-----	-----	
20,000	.06	-----	-----	
30,000	.12	.009	56 05	
40,000	.24	-----	-----	
44,200	.37	.013	57 40	
30,000	.60	-----	-----	
24,000	.79	-----	-----	
23,900	1.00	.042	10 58 55	
23,900	2.00	.077	10 00 00	Interruption.
37,100	4.00	-----	10 01 55	
40,400	6.00	.286	02 30	
38,600	8.00	.333	03 00	
37,600	10.00	.385	03 26	
37,100	12.00	.345	03 55	
36,200	14.00	.323	04 28	
36,000	16.00	.417	04 50	
34,100	18.00	.357	10 05 18	
32,200	20.00	.333	06 48	
30,000	22.00	.370	06 15	
28,500	23.61	.370	06 42	
			10 21 30	New stroke of piston. Test resumed.
27,800				
27,100	24.61	.104	10 22 18	
27,300	25.61	.263	22 37	
26,400	27.61	.308	23 10	
27,100	29.61	.338	23 40	
26,700	31.61	.357	24 08	
26,500	33.61	.400	24 33	
24,900	35.61	.400	24 58	
24,400	37.61	.333	25 28	
23,600	39.61	.417	25 52	
23,400	41.61	.385	26 18	
22,800	43.61	.357	26 46	
22,200	45.61	.435	27 09	
22,900	47.23	.454	27 31	
			10 40 00	New stroke of piston. Test resumed.
23,500				
21,300	48.23	.063	10 41 19	
20,500	49.23	.238	41 40	
21,100	51.23	.312	42 12	
21,000	53.23	.385	42 38	
20,100	55.23	.370	10 43 05	
20,000	57.23	.400	43 30	
20,200	59.23	.357	43 58	
20,200	61.23	.454	44 20	
20,100	63.23	.370	44 47	
20,500	65.23	.370	45 14	
16,000	67.23	.357	45 42	

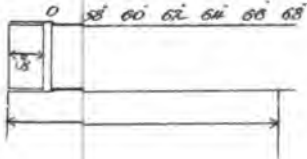
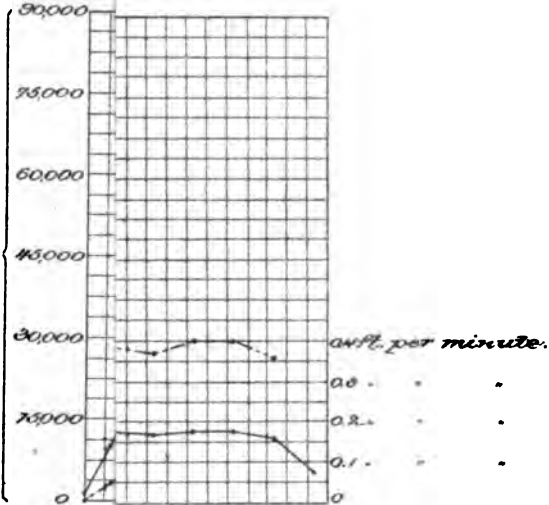
Bore

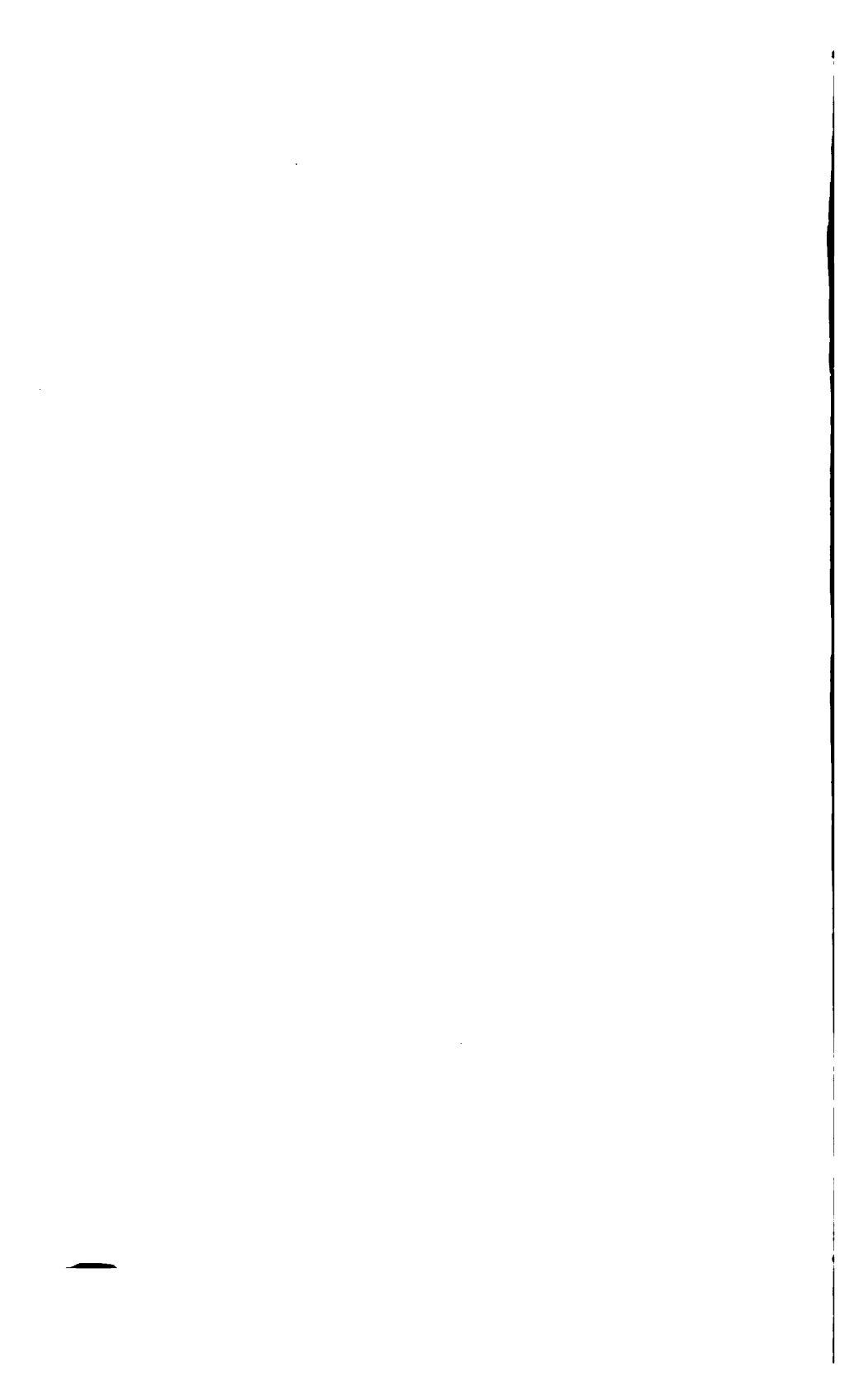
*Total load
on shell.
Lbs.*





*Total load
on shell.
Lbs.*

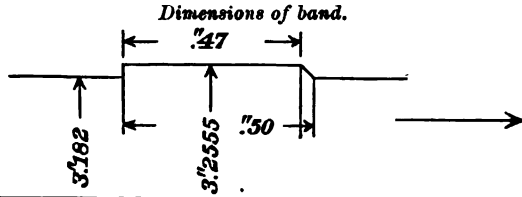




No. 8546.

Bore not lubricated.

Follower attached to antifriction nut, and shell pushed through the gun.



Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
1,000	0.	0.	2 31 00	Initial load.
2,000	.17			
3,000	.30			
4,000	.44			
5,000	.57			
6,000	.71			
7,000	.85			
8,000	.98			
9,000	1.10			
10,000	1.22	.041	2 33 30	
12,000	1.46			
14,000	1.78			
16,000	2.00			
20,000	2.55	.066	35 10	
22,700	4.00	.145	2 36 00	
25,200	6.00	.200	36 50	
22,300	8.00	.250	37 30	
21,900	10.00	.250	38 10	
21,200	12.00	.286	38 45	
20,400	14.00	.333	39 15	
19,900	16.00	.370	39 42	
18,800	18.00	.312	40 14	
16,900	20.00	.357	40 42	
15,900	22.00	.312	41 14	
16,200	23.60	.364	41 36	
			2 52 00	New stroke of piston. Test resumed.
15,100	23.65			
15,600	25.60	.083	2 54 00	
16,300	27.60	.333	54 30	
17,400	29.60	.345	54 59	
17,300	31.60	.435	55 22	
17,200	33.60	.357	55 50	
16,500	35.60	.400	56 15	
16,900	37.60	.357	56 42	
16,000	39.60	.357	57 10	
16,800	41.60	.400	57 35	
16,700	43.60	.400	58 00	
15,300	45.60	.357	58 28	
15,500	47.30	.354	58 52	
			3 07 30	New stroke of piston. Test resumed.
14,000	47.32			
14,100	49.30	.147	3 08 38	
14,100	51.30	.370	09 05	
13,800	53.30	.435	09 28	
12,600	55.30	.345	09 57	
13,400	57.30	.385	10 23	
12,500	59.30	.370	10 50	
13,500	61.30	.400	11 15	
13,500	63.30	.400	11 40	
11,800	65.30	.357	12 08	
5,000	67.30			

The lands of the gun sheared their way through the length of the band, and threw up a burr on each edge.

Filing off these burrs and measuring the band on a diameter which was covered by the grooves in the gun the band now measured 3".2678 diameter at the middle of its length, thus showing an enlargement of (3.2678—3.2555) ".0123 over the original diameter of the band.

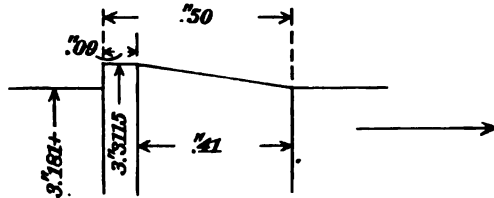
The band was crowning after the test, being sensibly larger in diameter at the middle of its length.

No. 8547.

Bore not lubricated.

Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.

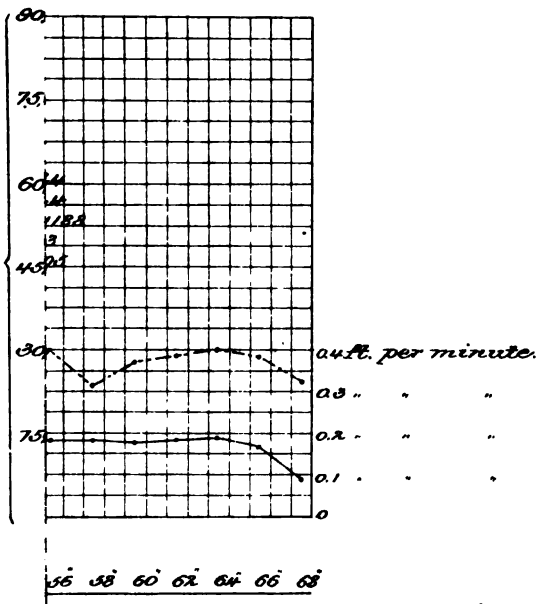


Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.	
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>		
1,000	0.	0.	8 34 30	Initial load.	
5,000	.01				
10,000	.02				
15,000	.03				
20,000	.07				
21,200	.11	.004	8 37 00		
15,000	.25				
12,500	.58				
14,000	1.00	.049	38 30		
17,700	2.00	.125	39 10		
21,800	3.00	.167	39 40		
23,100	4.00	.125	40 20		
24,800	6.00	.250	41 00		
22,400	8.00	.250	41 40		
22,500	10.00	.294	42 14		
22,800	12.00	.323	42 45		
22,500	14.00	.345	43 14		
22,100	16.00	.353	43 44		
20,200	18.00	.345	44 13		
18,300	20.00	.345	44 42		
17,800	22.00	.357	45 10		
17,600	23.69	.384	45 32		
			8 54 40		New stroke of piston. Test resumed.
18,000	23.71				
17,200	24.69				
17,600	25.69	.102	8 56 18		
17,900	27.69	.312	56 50		
18,200	29.69	.353	57 20		
17,500	31.69	.370	57 47		
17,100	33.69	.345	58 16		
16,300	35.69	.385	58 42		
16,200	37.69	.357	59 10		
16,000	39.69	.385	59 36		
15,900	41.69	.357	9 00 04		
16,900	43.69	.385	00 30		
19,900	45.69	.385	00 56		
15,600	47.44	.357	01 24		
			9 10 40	New stroke of piston. Test resumed.	
15,600	47.45				
15,400	48.44	.089	9 11 36		
15,100	49.44	.227	11 58		
14,000	51.44	.238	12 40		
14,400	53.44	.263	13 18		
13,500	55.44	.400	13 43		
13,500	57.44	.312	14 15		
13,200	59.44	.370	14 42		
13,600	61.44	.385	15 08		
14,000	63.44	.400	15 33		
12,400	65.44	.385	15 59		
6,500	67.40	.323	16 30		

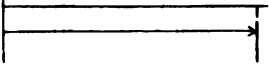
Diameter over band opposite grooves in the gun after the test, about 3.3''/10.

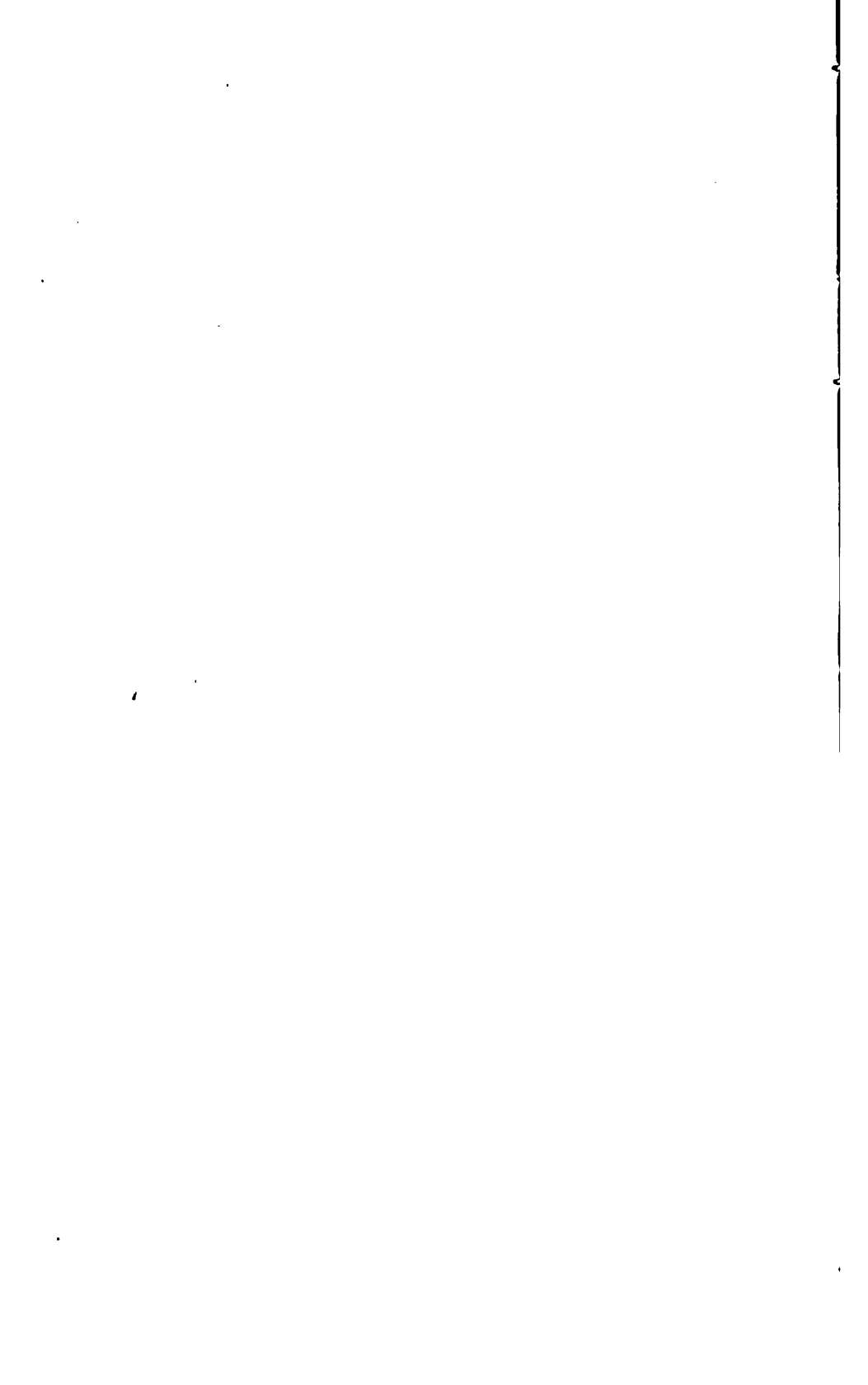
Copper in the band, opposite the lands, flowed to the rear about ''18±.

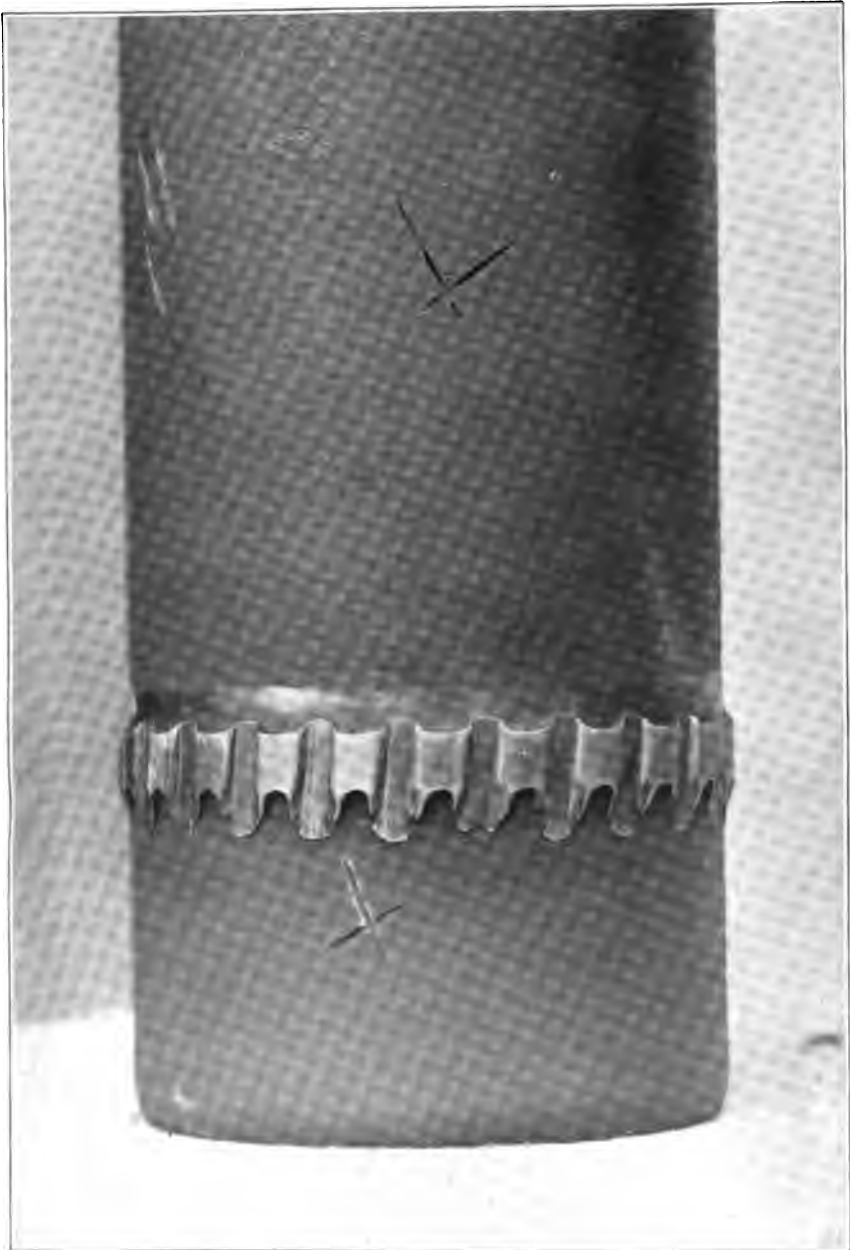
Total load
on shell.
Lbs.



56 58 60 62 64 66 68





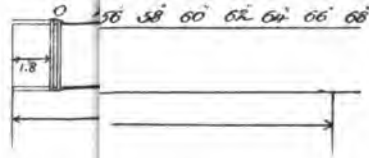
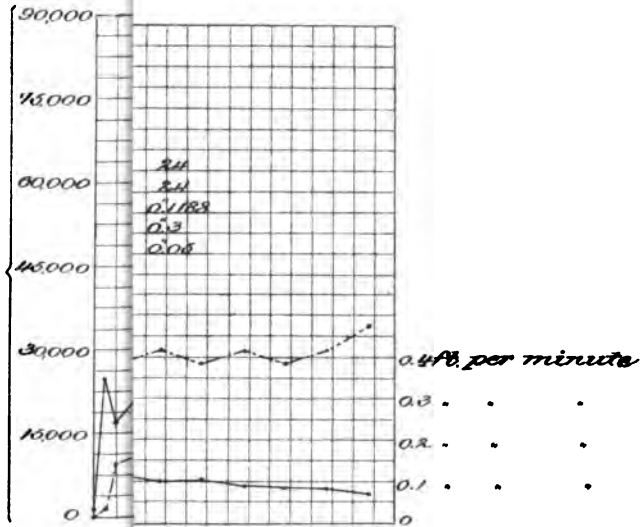


PHOTOGRAPH OF BASE OF 3.2-INCH SHELL, SHOWING CONDITION OF COPPER BAND AFTER BEING FORCED THROUGH BORE OF RIFLE.

EXPERIMENT No. 8549.



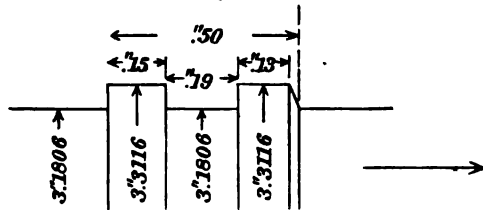
*Total load
on shell.
Lbs.*



No. 8553.

Bore not lubricated.
Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.

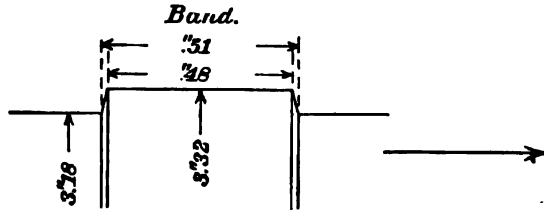


Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	Inches.	foot.	h. m. s.	
1,000	0.	0.	2 45 00	Initial load.
10,000	.03			
15,000	.07			
17,000	.15			
12,000	.32			
22,000	.40			
23,000	.42			
24,600	.46			
23,000	.53	.016	2 47 40	
20,000	.61			
17,100	1.00	.127	2 48 38	
21,600	2.00	.147	49 12	
30,500	4.00	.208	50 00	
36,300	6.00	.323	50 31	
40,600	8.00	.323	2 51 02	
37,200	10.00	.417	51 26	
33,700	12.00	.476	51 47	
33,300	14.00	.385	52 13	
27,200	16.00	.417	52 37	
23,800	18.00	.400	53 02	
19,100	20.00	.400	53 27	
18,800	22.00	.500	53 47	
17,700	22.95	.432	53 58	
			3 24 00	New stroke of piston. Test resumed.
20,100	22.96			
17,800	23.96	.064	3 25 32	
15,700	24.95	.192	25 58	
14,200	26.95	.357	26 26	
15,100	28.95	.417	26 50	
16,100	30.95	.385	27 16	
13,700	32.95	.417	27 40	
13,500	34.95	.417	28 04	
11,800	36.95	.400	28 29	
10,200	38.95	.435	28 52	
9,200	40.95	.385	29 18	
9,000	42.95	.435	29 41	
9,700	44.95	.400	30 06	
9,600	46.73	.405	30 28	
12,800				Resistance when end of stroke was reached and travel of shell ceased. This higher resistance was gradually reached, and after the lapse of 3 to 4 minutes the load on the scale advanced still more, going to 14,100 pounds, all motion of the shell having ceased in the first instance. Similar phenomena have been observed in earlier tests. At the expiration of 20 minutes the increase in resistance had nearly ceased, the load on the scale now being 15,600 pounds. The load was now released and a new stroke of piston taken.
			3 54 00	Test resumed.
12,200	46.75			
9,300	47.73	.055	3 55 30	
10,200	48.73	.278	55 48	
10,500	50.73	.323	56 19	
9,200	52.73	.417	3 56 43	
8,700	54.73	.385	57 09	
7,500	56.73	.417	57 33	
7,600	58.73	.385	57 59	
6,800	60.73	.417	58 23	
6,500	62.73	.385	58 49	
6,200	64.73	.417	59 13	
5,000	66.73	.476	59 34	

3.2-INCH B. L. STEEL FIELD RIFLE. MODEL 1890.

Gun branded { At muzzle, { "No. 1 Watervliet Arsenal.
1893. 798 lbs. F. E. H."
On trunnion, "3.2 inch model 1890."
On trunnion hoop, "Proof Gun U. S."

No. 8628.

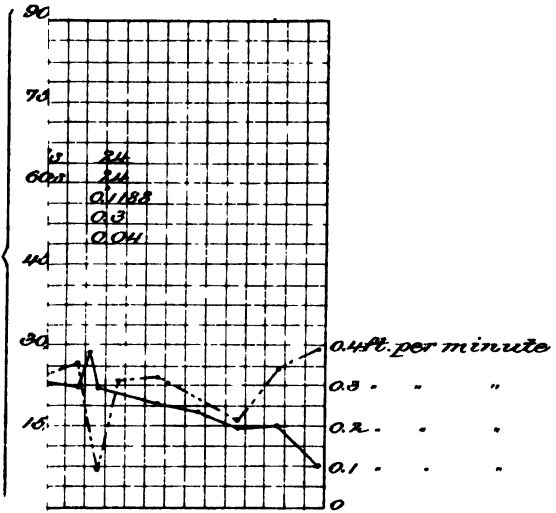


Bore of gun swabbed with cotton waste, which removed excess of grease used to prevent rust in shipping.
Shell pushed through the gun, using antifriction nut.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	Inches.	Foot.	h. m. s.	
14,000	0.		8 43 40	Initial load.
20,000	.03			
25,000	.07			
30,000	.10			
35,000	.16			
40,000	.25			
45,000	.34			
45,600	.38			
38,000	.66	0.027	8 45 30	
36,500	1.00			
39,200	2.00	.223	8 46 00	
45,800	4.00	.357	8 46 28	
51,000	6.00	.370	8 46 55	
49,900	8.00	.400	8 47 20	
	9.33			Follower bar bent. Test discontinued while a new bar was prepared.
			10 43 30	Test resumed.
60,400				Maximum resistance.
48,500				Continues movement.
52,500	10.33	.005	10 45 20	
50,100	11.33	.167	45 50	
49,800	13.33	.357	46 18	
51,300	15.33	.270	46 55	
50,400	17.33	.400	47 20	Throbs.
45,000	19.33	.333	47 50	
59,200	21.33	.333	48 20	
36,900	23.33	.357	48 48	
34,500	25.33	.370	49 15	
32,100	27.33	.357	49 43	
30,600	29.33	.370	50 10	
30,200	31.33	.357	50 38	
29,700	32.94	.447	10 50 56	
			10 59 20	New stroke of piston. Test resumed.
36,600				Maximum resistance.
27,300	33.94	.074	11 00 28	
27,500	34.94	.357	11 00 42	
27,900	36.94	.357	01 10	
28,100	38.94	.357	01 38	
28,800	40.94	.370	02 05	
26,100	42.94	.385	02 31	
26,100	44.94	.400	02 56	
24,600	46.94	.385	03 22	
24,200	48.94	.385	03 48	
24,100	50.94	.385	04 14	
23,200	52.94	.385	04 40	
23,200	54.94	.323	05 11	
22,000	56.63	.352	11 05 35	End of stroke. Resistance rose to this load as piston ceased to move.
27,600				New stroke of piston.

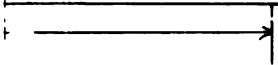
e.

Total load
on skull,
Lbs.



56 58 60 62 64 66 68

*Calc. from





No. 8628—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>A. m. s.</i>	
28,800	-----	-----	11 13 40	Test resumed.
21,700	57.63	.094	11 14 33	Maximum resistance.
20,900	58.63	.312	14 49	
19,000	60.63	.328	15 20	
17,800	62.63	-----	11 20 00	Test interrupted.
14,800	64.63	.217	20 46	
15,100	66.63	.345	21 15	
7,600	67.63	.385	11 21 28	

Hardly any trace of lubricant in front of the band when the shell came from the gun.

No. 8629.

Same gun as in experiment No. 8628, and shell and band of same dimensions.

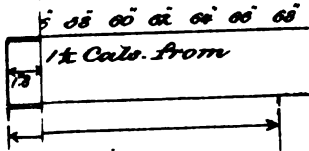
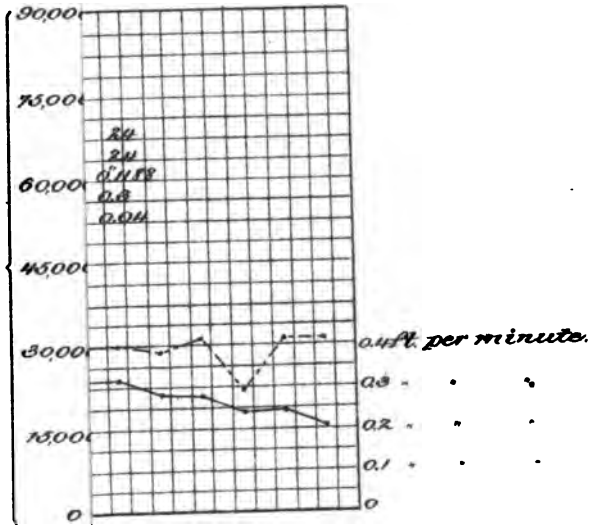
Shell pushed through the gun, antifriction nut used.

Bore not lubricated.

Resistance.		Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.	
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h.</i>	<i>m.</i>	<i>s.</i>			
5,000	0.		1	20	10	Initial load.	
10,000	.02	.....					
20,000	.08	.....					
25,000	.13	.....					
30,000	.21	.....					
35,000	.35	.....					
37,100	.40	.....					
35,000	.47	.....					
33,000	.53	.....					
30,000	.62	.....		1	26	25	
28,000	.73						Speed of piston increased.
28,100	1.00	0.007		27	15			
34,300	2.00	.143		27	50			
39,600	4.00	.250		28	30			
44,800	6.00	.263		29	08			
42,800	8.00	.312		29	40			
44,300	10.00	.357		30	08			
41,200	12.00	.370		30	35			
41,000	14.00	.370	1	31	02			
38,600	16.00	.370		31	29			
38,000	18.00	.385		31	55			
33,700	20.00	.400		32	20			
27,700	22.00	.357		32	48			
27,000	23.78	.371		33	12			
29,900					Stroke of piston exhausted. Resistance increased to this load as piston ceased to move. New stroke of piston. Test resumed.	
				1	42	40		
33,100						Maximum resistance.
25,900	24.78	.069	1	48	52			
25,900	25.78	.312		44	08			
24,100	27.78	.312		44	40			
24,100	29.78	.400		45	05			
25,200	31.78	.370		45	32			
23,300	33.78	.417		45	56			
22,900	35.78	.400		46	21			
23,100	37.78	.400		46	46			
23,500	39.78	.357		47	14			
23,300	41.78	.323		47	45			
21,500	43.78	.345		48	14			
22,500	45.78	.500		48	34			
22,200	47.56	.404		48	56			
23,800					Stroke of piston exhausted. Resistance increased to this load. New stroke of piston. Test resumed.	
				1	56	06		
27,200						Maximum resistance.
22,800	48.56	.072	1	57	15			
21,900	49.56	.333		57	30			
22,400	51.56	.400		57	55			
22,600	53.56	.435		58	18			
23,700	55.56	.400		58	43			
23,600	57.56	.400		59	08			
21,200	59.56	.385		59	34			
21,000	61.56	.417		59	58			
18,000	63.56	.294	2	00	32			
18,400	65.56	.417		00	56			
15,200	67.56	.417		01	20			

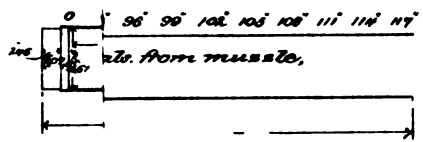
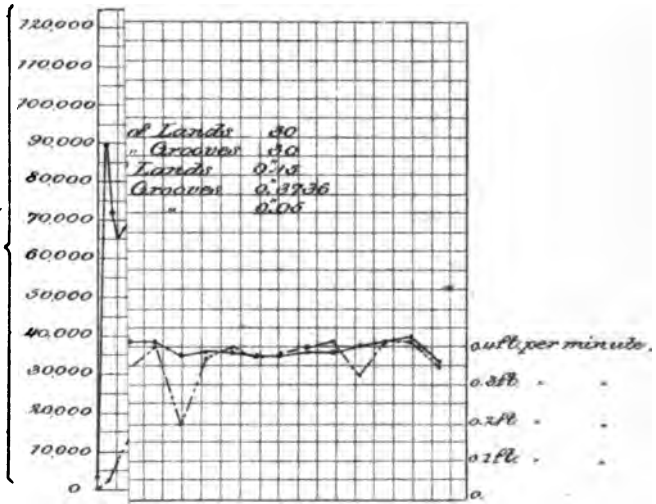
v.

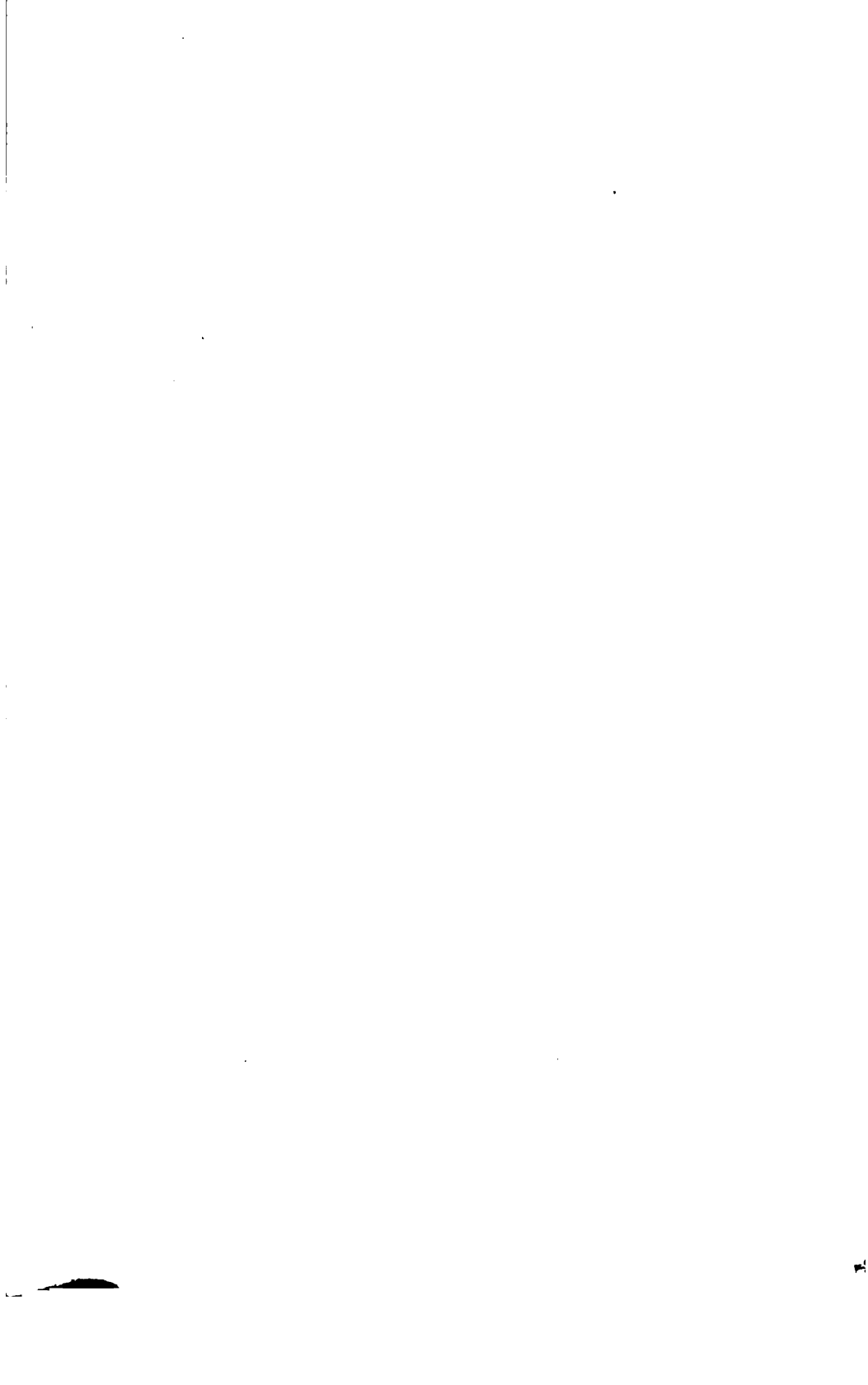
Total load
on shell.
Lbs.





Total load
on shell.
Lbs.



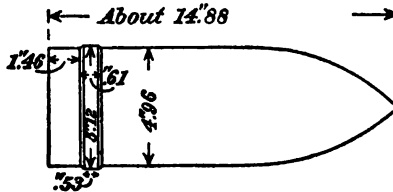


5-INCH B. L. STEEL SIEGE RIFLE.

No. 8369.

Marks on rifle:

“Model 1890” on trunnion.
 “5-in., No. 1, Wt. 3,630 lbs.
 F. E. H., Insp.
 Watervliet Arsenal, 1893,” } on muzzle.



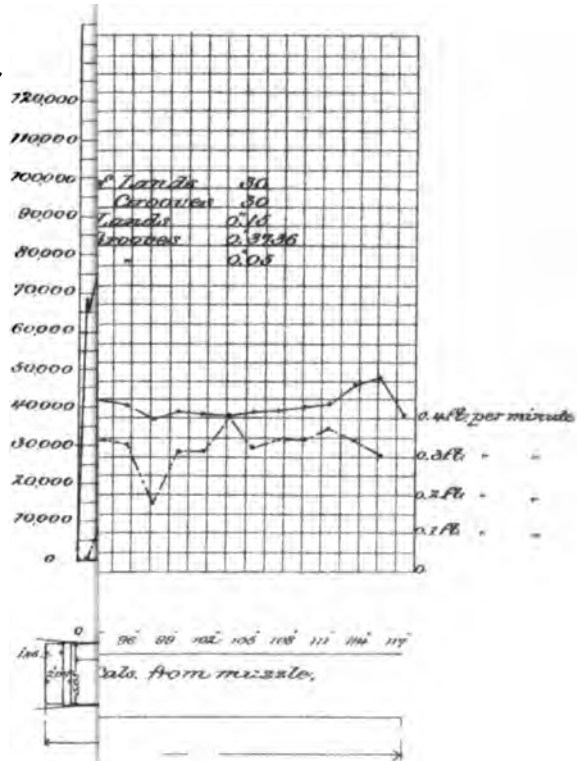
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	Inches.	Foot.	h. m. s.	
5,000	0.	0.	3 00 00	Initial load.
30,000	.13			
50,000	.23			
60,000	.30			
70,000	.35			
80,000	.41		3 11 00	
89,000	.58		11 30	
82,000	.76			
72,000	1.00	.026	3 12 10	
65,000	1.50	.071	12 45	
73,000	3.00	.167	3 13 30	
79,700	5.00	.143	14 40	
77,700	7.00	.200	15 30	
84,000	8.25	.156	16 10	
83,100	9.00		16 40	
89,600	10.00	.146	17 10	
98,800	12.00	.167	18 10	
99,900	14.00	.143	19 20	
104,200	15.50			
102,100	16.00	.143	3 20 30	
102,000	18.00	.148	21 40	
104,300	20.00	.147	22 48	
101,100	22.00	.143	23 58	
101,600	22.50	.144	24 50	
90,000	23.50		3 34 00	New stroke of piston taken.
96,200	25.50	.143	35 10	
93,300	27.50	.333	35 40	
92,700	29.50	.263	36 18	
90,500	31.50	.312	36 50	
86,300	33.50	.333	37 20	
82,700	35.50	.333	37 50	
80,600	37.50	.312	38 22	
79,700	39.50	.357	38 50	
78,200	41.50	.312	39 22	
74,300	43.50	.303	3 39 55	
75,700	45.50	.333	3 40 25	
72,300	47.50	.286	41 00	
70,000	47.50		3 49 00	New stroke of piston taken.
69,600	49.50	.200	49 50	
65,000	51.50	.333	50 20	
60,100	53.50	.333	50 50	
55,200	55.50	.333	51 20	
53,700	57.50	.312	51 52	
55,300	59.50	.312	52 24	
55,000	61.50	.333	52 54	
55,200	63.50	.312	53 26	
52,800	65.50	.323	53 57	
51,800	67.50	.328	54 28	
51,300	69.50	.333	54 58	
51,300	71.50	.333	55 28	New stroke of piston taken.

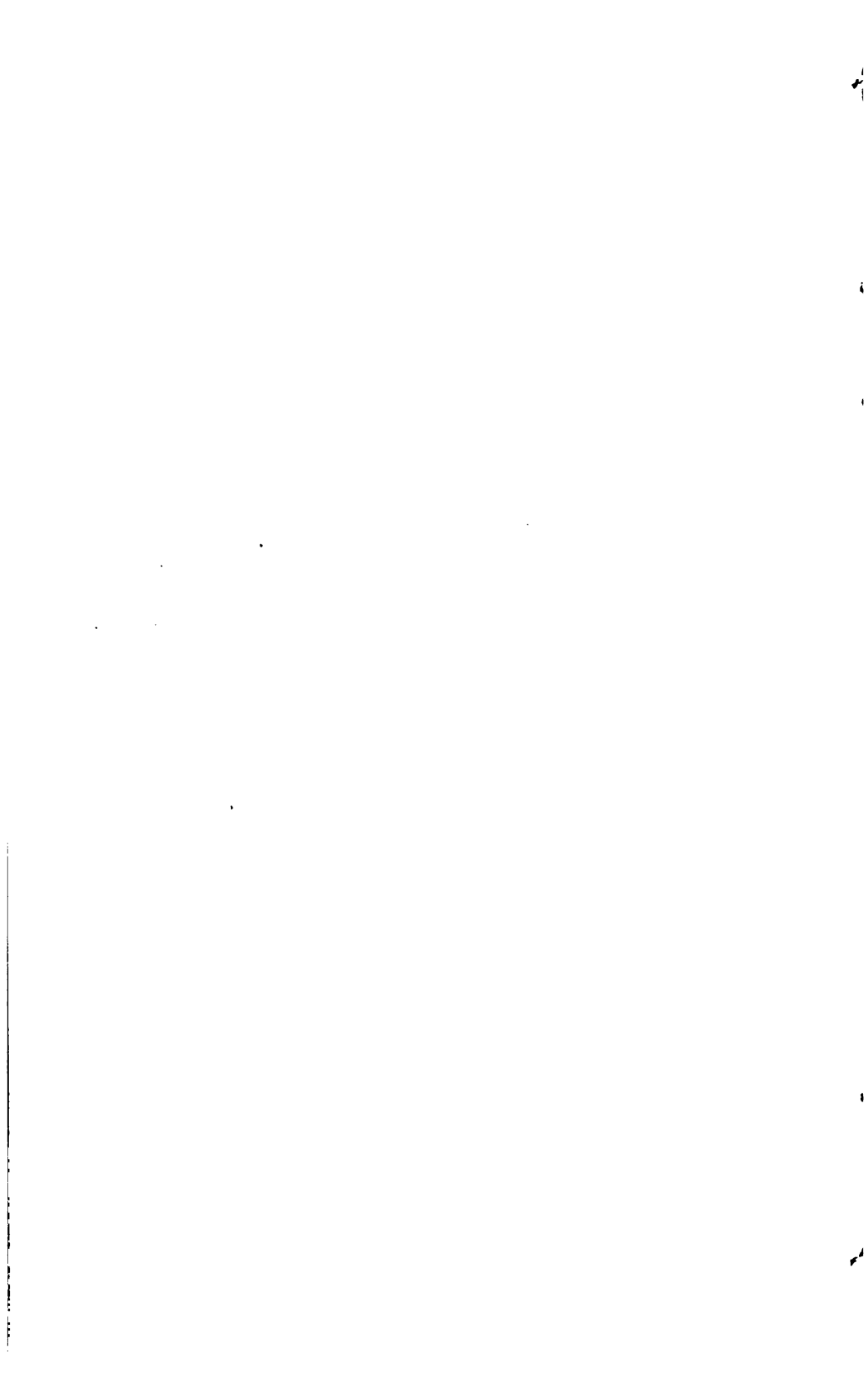
No. 8369—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
49,000	71.50	.....	4 03 10	
50,200	73.50	.167	04 10	
49,900	75.50	.500	04 30	
48,800	77.50	.312	05 02	
46,800	79.50	.385	05 28	
46,500	81.50	.345	05 57	
46,600	83.50	.370	06 24	
43,600	85.50	.370	06 52	
44,100	87.50	.370	07 19	
43,700	89.50	.417	07 43	
42,200	91.50	.323	08 14	
41,100	93.50	.345	08 43	
41,100	95.50	.400	09 08	
39,000	95.50	.....	4 43 10	New stroke of piston taken.
37,900	97.50	.200	44 00	
38,800	99.50	.370	44 27	
38,400	101.50	.400	44 52	
37,700	103.50	.370	45 19	
37,900	105.50	.385	45 45	
38,600	107.50	.400	46 10	
38,100	109.50	.417	46 34	
40,300	111.50	.323	47 05	
41,300	113.50	.417	47 29	
42,500	115.50	.417	47 53	
36,000	117.50	.345	4 48 22	Test completed.

Opposite the lands the copper in the band was forced to the rear about ".47 and opposite the grooves about ".09, the total length at these two parts being 1".08 and ".70, respectively.

*Total load
on shell
Lbs.*





No. 8370.

Shell rebanded and again forced through the rifle.
 Dimensions of band same as in preceding test.

NOTE.—There was a slight deficiency of metal in the band; hence it did not turn up to full exterior diameter at all parts of the circumference.

Resistance.		Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	Inches.	Foot.	h. m. s.		
5,000	0.	8 43 30	Initial load.	
10,000	.02	.....	.....
20,000	.07	.....	.....
30,000	.15	.....	8 45 00	
35,000	.17	.....	.....
40,000	.20	.....	.....
45,000	.23	.....	.....
50,000	.27	.....	.....
55,000	.33	.....	.....
60,000	.37	.....	8 47 30	
65,000	.43	.....	.....
68,500	.55	.....	.....
68,000	.65	0.010	8 49 00		
78,500	1.72	.080	50 00		
79,400	2.50	.197	50 30		
80,800	4.00	.183	51 00		
81,000	6.00	.222	51 45		
94,500	8.00	.322	8 52 30		
95,400	10.00	.204	53 19		
96,000	12.00	.213	54 06		
103,300	14.00	.200	54 56		
94,200	18.00	.217	55 42		
91,500	18.00	.217	56 28		
96,500	20.00	.213	57 15		
98,500	22.00	.175	58 12		
89,400	23.70	.118	59 24		
78,000	23.80	9 17 00	New stroke of piston taken.	
83,900	25.70	.128	18 14		
79,100	29.70	.208	19 50		
74,700	31.70	.222	20 35		
72,800	33.70	.217	21 21		
70,500	35.70	.233	22 04		
69,600	37.70	.238	22 46		
71,100	39.70	.233	23 29		
70,200	41.70	.244	24 10		
69,000	43.70	.154	25 15		
67,600	45.70	.119	26 39		
66,700	47.70	.123	28 00		
64,000	47.80	.....	9 37 00	
64,000	49.70	.198	37 48		
60,100	51.70	.294	38 22		
55,800	53.70	.345	9 38 51		
52,200	55.70	.323	39 22		
52,500	57.70	.357	39 50		
54,200	59.70	.367	40 18		
53,600	61.70	.333	40 48		
55,700	63.70	.333	41 18		
55,100	65.70	.357	41 46		
55,000	67.70	.357	41 14		
54,600	69.70	.345	41 43		
54,200	71.70	.312	42 15		
51,400	71.80	9 55 00	New stroke of piston taken.	
52,500	73.70	.271	9 55 35		
52,400	75.70	.250	56 15		
51,100	77.70	.270	56 52		
50,600	79.70	.250	57 32		
50,300	81.70	.278	58 08		
49,200	83.70	.270	58 45		
47,400	85.70	.303	59 18		
48,500	87.70	.312	59 50		
49,200	89.70	.312	10 00 22		
45,800	91.70	.323	00 53		
44,800	93.70	.345	01 22		
43,000	95.58	.336	01 50		

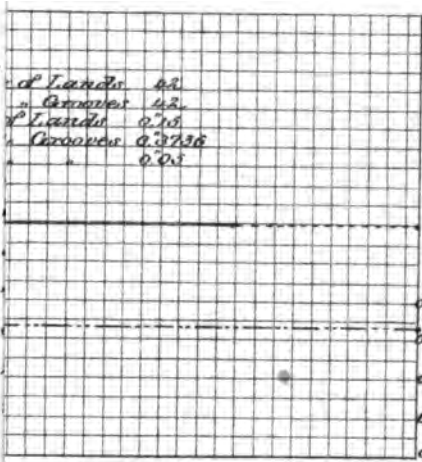
No. 8370—Continued.

Resistance.		Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h.</i>	<i>m.</i>	<i>s.</i>		
40, 200	95.58	10	26	00	Test completed.	
39, 500	97.58	.176		26	54		
41, 300	99.58	.312	10	27	28		
41, 000	101.58	.312		27	58		
40, 200	103.58	.400		28	23		
41, 300	105.58	.323		28	54		
41, 400	107.58	.345		29	23		
42, 800	109.58	.345		29	52		
43, 500	111.58	.370		30	19		
48, 400	113.58	.345		30	48		
51, 100	115.58	.308	10	31	21		
41, 000	117.58	.....				

Opposite the lands the copper band was ".98 long and opposite the grooves ".66 long after the test.

Of the total ".98 opposite the lands, about ".05 represents the flow of the band in a forward direction; hence the amount of flow toward the rear at this place was ".98 - (.05 + ".61) = ".32.

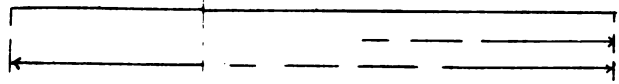
Opposite the grooves there was hardly any perceptible forward flow of the copper.

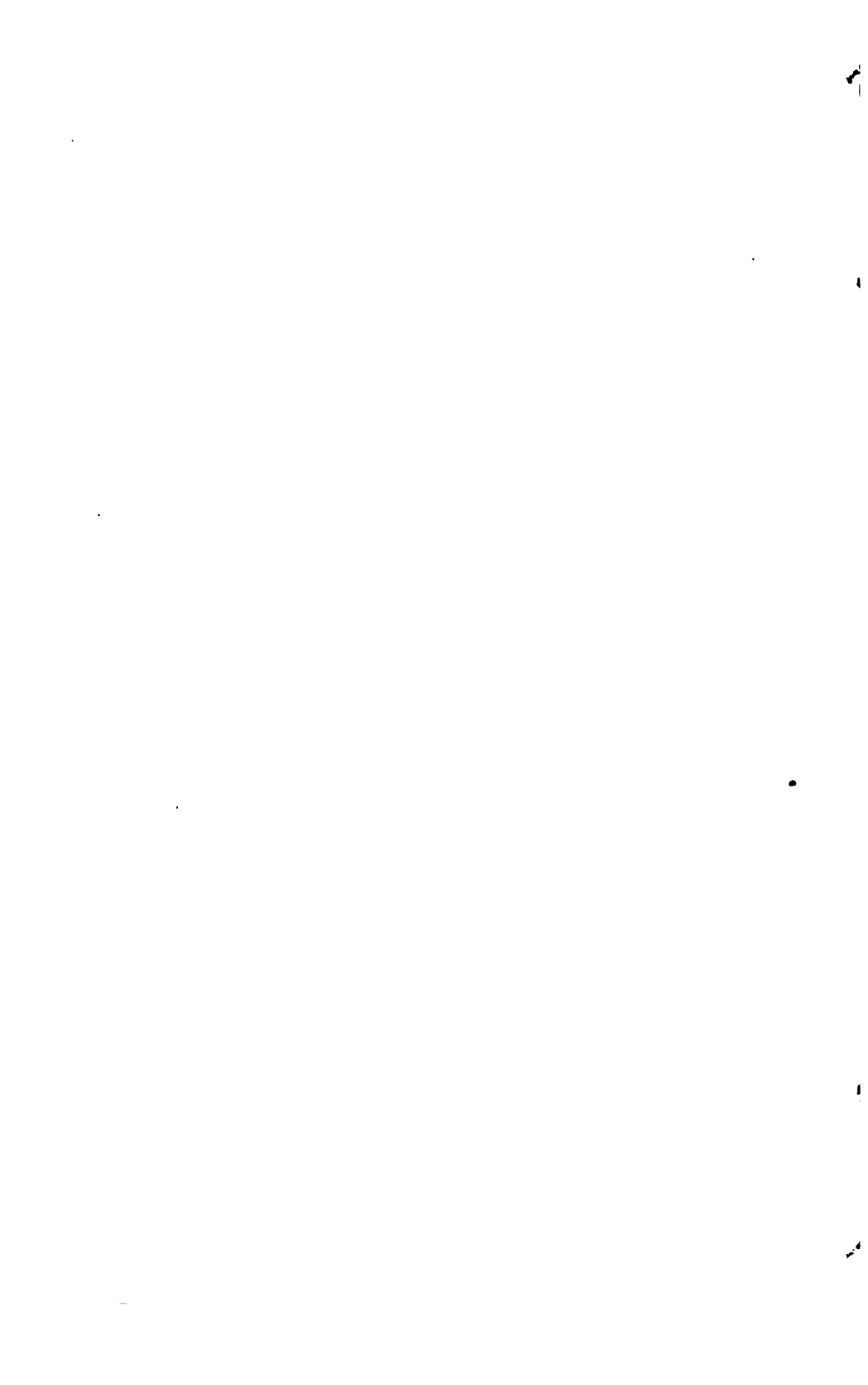


Total load
 on shell,
 Lbs.

5 60 61 62 63 64 65 66 67 68 69

to Turn in 25 Cals. at



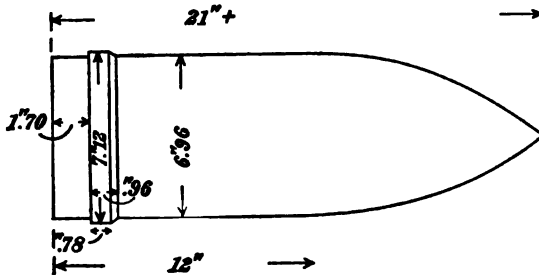


7-INCH B. L. STEEL SIEGE HOWITZER.

No. 8357.

Marks on gun :

“Model 1890” on trunnion.
 “7-in No. 5 Wt. 3710 lbs.
 W. S. P. Insp.
 Watervliet Arsenal 1893” } on muzzle.



Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
2,500	0.	0.	11 39 00	Initial load.
32,000	.05	.....	40 00	
36,000	.10	.....	40 30	
44,000	.20	.....	
57,000	.34	.....	41 00	
76,800	.50	.....	42 00	
88,600	.70	.....	
71,000	.80	.....	43 00	
56,000	.90	.....	
44,000	1.00	.017	44 00	
44,000	2.00	.167	44 30	Rapid rate.
46,500	3.00	.167	11 45 00	
55,100	4.00	.....	
58,700	5.00	.167	46 00	
59,800	6.00	.....	
59,700	7.00	.333	46 30	
58,600	8.00	.....	
63,400	9.00	.....	
60,200	10.00	.250	47 30	
61,600	11.00	.....	
63,000	12.00	.....	
64,800	13.00	.....	
66,400	14.00	.222	49 00	
69,100	15.00	.....	
69,800	16.00	.....	
69,700	17.00	.....	
74,400	18.00	.333	50 00	
77,500	19.00	.....	
78,400	20.00	.222	50 45	
53,000	20.07	.....	53 00	Piston stationary 2½ minutes.
63,600	20.08	.....	
63,900	20.09	.....	
63,800	20.10	.....	
63,400	20.15	.....	55 30	
63,300	20.16	.....	56 00	
81,000	20.40	.....		Load momentarily reached.
53,300	20.42	.....	59 20	
83,300	20.62	.....		Load momentarily reached.
53,200	20.62+	.004	12 03 00	
85,000	20.86	.....		Load momentarily reached. Rested 40 minutes; the load in the meantime fell to 43,200 pounds.

No. 8357—Continued.

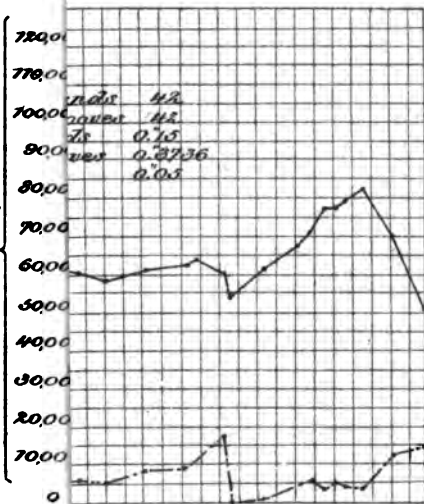
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
43,200	20.86	-----	12 42 00	
68,700	20.87	-----	45 00	
66,600	20.88	-----	-----	
60,600	20.89	-----	-----	
64,900	20.90	-----	-----	
65,200	20.91	-----	48 00	
65,300	20.92	-----	-----	
65,300	20.93	-----	-----	
65,300	20.94	-----	-----	
65,300	20.95	-----	47 00	
85,000	21.30	.001	48 00	Load momentarily reached.
4,000	-----	-----	-----	Load released and rested 3 minutes.
78,800	21.62	-----	-----	Load momentarily reached.
70,000	23.00	-----	-----	Load maintained uniform between 21".65 and 23".00. Rapid rate of movement of shell.
60,000	23.20	-----	12 54 00	
60,000	23.40	-----	56 30	
60,000	23.50	-----	57 15	
60,000	23.60	.007	58 30	
				The variation in speed of shell was intentionally arranged to maintain a resistance of 70,000 and 60,000 pounds, respectively, as shown above.
37,000	23.65	-----	2 45 00	
50,000	23.66	-----	47 00	
62,800	23.68	-----	49 00	
61,000	23.70	-----	49 30	
61,000	23.76	-----	-----	
				Accelerating the speed increased the resistance to 70,000 pounds. Speed then again reduced until the resistance was 61,000 pounds.
61,000	23.92	-----	2 58 19	
70,000	24.00	-----	-----	
68,000	25.64	.167	-----	Resistance 68,000 pounds while the shell traveled from 24" to 25".64, the interval of time being about 40 seconds.
63,000	-----	-----	-----	Rate of travel of shell 2" per minute; continued at this speed up to the end of the stroke of the testing machine, 24".

Another stroke of the piston taken, and run at speed of 4" per minute, the resistance now averaging 60,000 pounds; at times reaching 63,000 pounds, and at other times falling to 57,000 pounds.

During the last 10" of the travel of the shell in the gun the resistance increased and reached a maximum of 90,000 pounds, attributed to the rear end of the shell cramping in the bore. There were fluctuations in the resistance during this stage.

There was some abrasion of the copper band, but the principal effect was a flow of the metal under the lands of the gun, which forced the copper toward the base of the shell about ".20 at each land.

Total load
on shell
Lbs.



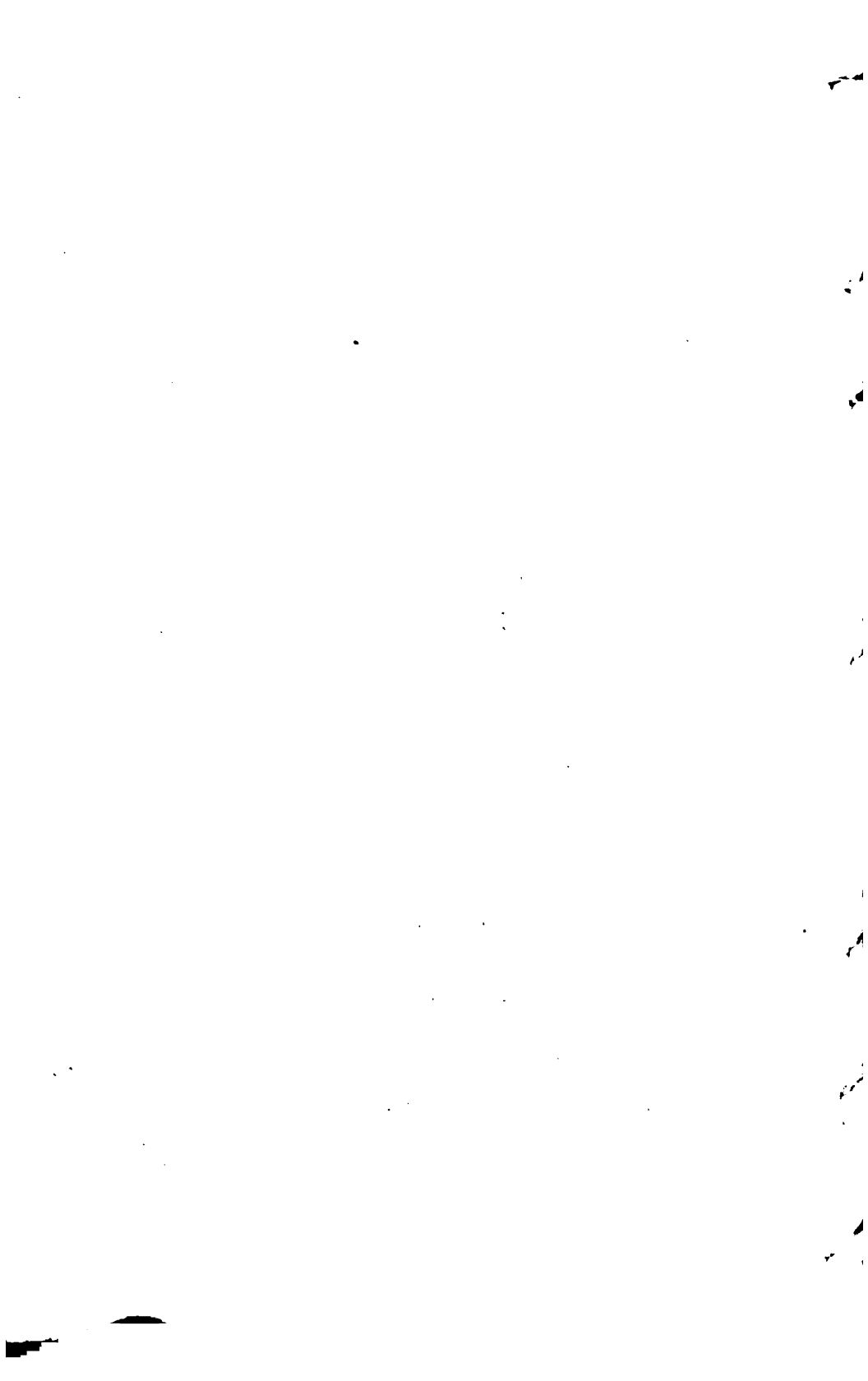
11.01 42
10.00 42
8.00 0.15
7.00 0.2736
6.00 0.03

0.3 ft. per minute
0.2 ft. "
0.1 ft. "

0 2 4 6 8 10 12 14 16 18

1 Turn in 25 Cals.





No. 8358.

[Second experiment.]

Shell rebanded and again forced through gun.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
Pounds.	Inches.	Foot.	h.	m.	s.	
5,000	0.	0.	2	08	00	Initial load.
44,500	.05	.....		09	00
61,400	.10	.....		10	00
78,200	.20	.....		11	25
83,100	.30	.....		12	10
88,800	.40	.....		12	40
94,100	.50	.008		13	15	
99,900	.60	.....		13	50
97,200	.70	.....		14	30
91,100	.75	.....		14	45
82,800	.80	.....		15	00
87,200	.90	.....		15	30
61,300	1.00	.016		15	55	
59,000	1.10	.....			
59,400	1.20	.....		16	50
60,500	1.70	.....		19	25
60,600	2.00	.017		20	45	
58,900	2.5	.....		23	35
61,200	3.0	.....		26	40
63,700	3.5	.....		30	10
64,300	4.0	.012		34	00	
66,400	4.5	.....	2	38	23
67,300	5.0	.....		43	29
67,000	5.5	.....		49	44
66,900	5.71	.008		52	40	
69,700	5.80	.....		53	45
70,000	6.00	.010		55	05	
70,300	6.50	.....		59	40
71,600	6.60	.....	3	00	30
70,300	7.00	.010		03	40	
69,400	7.50	.....		08	07
66,000	8.00	.009		12	56	
66,300	8.50	.006		19	29	
68,500	9.00	.....		24	40
68,100	9.50	.....		30	55
5,000		.....		39	00
5,000	9.49	.0001	3	48	30	Load released to initial load while accumulator weights were pumped up. Readings taken during one setting of testing-machine valves.
30,500	9.50			49	40	
53,200	9.51			51	50	
61,900		.0001	4	02	30	Valves closed, with pressure left on shell.
61,400	9.52			14	15	
62,400	9.53					
62,600			4	26	30	Temperature of testing room about 68° F. Test discontinued.
60,600			4	35	30	
60,100						Load found on shell after about 39½ hours' rest. The temperature of the testing room was then 48° F., but during the interval of rest had been lower.
15,700	9.50+					The reduction in load attributed largely to fall in temperature in the testing room, diminishing the volume of oil in straining cylinder.
15,700			8	00	00	Valves of testing machine remain at one setting.
20,000				00	10	
25,000				00	32	
30,000				00	56	
35,000			8	01	20	
40,000	9.52			01	43	
45,000				02	3	
50,000				02	23	
55,000				02	43	
60,000			8	03	04	
65,000				03	28	
68,000	9.53			03	43	
75,000				04	08	
79,800	9.54	.0007		04	40	Maximum resistance after rest.

No. 8358—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.	
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>		
70,000	9.55	05 02	Valves of testing machine remain at one setting.	
69,000	9.56	.....	06 00	
68,700	9.57	.....	06 20	
67,700	9.58	.....	08 00	
67,600	9.59	.....	09 00	
67,300	9.60	.....	10 00	
67,150	9.60+	.....	12 00	
67,080	9.61	.....	14 00	
66,950	9.63	.....	20 00	
66,950	9.66	.....	25 00	
67,100	9.67	30 00	Valves changed. Speed increased slightly.	
67,380	9.66	.....	35 00	
67,540	9.70	.0004	40 00	Valves again changed, slightly increasing speed of shell.	
70,300	9.70	.....	8 41 00	
69,500	9.72	.0004	8 45 00	Valves again changed.	
71,200	.....	.....	8 45 30
71,000	9.74	.....	46 00	
70,600	9.80	.....	50 00	
70,200	9.97	.....	9 03 00	
70,600	10.10	.....	17 00	
71,600	10.20	40 00	Valves again changed.	
72,080	10.44	.0008	10 04 00		
75,300	10 05 00	Valves again changed.	
75,600	10.47	.....	05 08	
73,700	10.51	.....	07 00	
73,200	10.53	.....	08 00	
73,080	10.55	.....	09 00	
72,800	10.58	.....	10 00	
72,640	10.60	.....	11 00	
72,500	10.61	.....	12 00	
72,300	10.64	.....	13 00	
72,100	10.66	.....	14 00	
71,940	10.68	.....	15 00	
71,900	10.70	.....	16 00	
71,800	10.71	.....	17 00	
71,720	10.73	.....	18 00	
71,580	10.76	.....	19 00	
71,490	10.78	.....	20 00	
71,380	10.79	.....	21 00	
71,280	10.81	.....	22 00	
71,200	10.82	.....	23 00	
71,070	10.84	.....	10 24 00	
71,000	10.87	.....	25 00	
70,870	10.89	.....	26 00	
70,800	10.90	.....	27 00	
70,860	10.91	.....	28 00	
70,900	10.93	.....	29 00	
70,900	10.96	.....	30 00	
70,880	10.98	.0017	31 00		
75,600	11.00	10 31 30		Valves again changed.
75,150	11.03	.....	32 00	
74,860	11.12	.....	33 00	
74,600	11.20	.....	34 00	
74,320	11.28	.....	35 00	
74,020	11.35	.....	36 00	
73,880	11.42	.....	37 00	
73,720	11.50	.....	38 00	
73,420	11.58	.....	39 00	
73,310	11.63	.....	40 00	
73,200	11.71	.....	41 00	
72,500	11.79	.....	42 00	
72,200	11.85	.....	43 00	
71,920	11.81	.....	44 00	
71,720	11.98	.....	45 00	
71,300	12.04	.....	46 00	
71,210	12.11	.....	47 00	
71,100	12.17	.006	48 00		
				Valves again changed.	

No. 8358—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h.</i>	<i>m.</i>	<i>s.</i>	
78,400	.....	.....	10	48	20	
79,200	12.33	.....		48	50	
79,940	12.65	.....		50	00	
80,980	12.93	.....		51	00	
81,120	13.19	.....		52	00	
81,100	.....	.....		52	30	
80,980	13.42	.0218		53	00	
81,350	13.66	.....		54	00	
81,900	13.88	.....		55	00	
83,120	14.09	.....		56	00	
84,100	14.28	.....		57	00	
84,220	14.49	.....		58	00	
83,950	.....	.....		58	30	
83,800	14.68	.....		59	00	
84,100	14.85	.....	11	00	00	
84,900	15.03	.....	11	01	00	
85,060	15.21	.0186		02	00	
97,400	15.48	.....	11	02	30	Valves again changed.
96,200	15.94	.....		03	00	
93,600	16.42	.....		08	30	
94,600	16.89	.....		04	00	
97,900	17.35	.....		04	30	
99,800	17.79	.....		05	00	
101,600	18.24	.....		05	30	
103,200	18.65	.....		06	00	
108,700	18.87	.0753		06	15	
74,800	18.91	.....	11	47	00	Valves closed and new stroke of accumulator piston taken.
88,900	18.92	.....		48	00	Load at end of rest.
85,000	18.93	.....		49	00	
84,050	18.95	.....		50	00	
83,400	18.96	.....		51	00	Valves gradually opened.
85,400	18.98	.....		52	00	
86,800	19.00	.....		53	00	
88,080	19.06	.....		54	00	
89,800	19.15	.....		55	00	
91,200	19.27	.....		56	00	
91,440	19.38	.....		57	00	
91,650	19.51	.....		58	00	
91,920	19.64	.....		59	00	
92,400	19.75	.0054	12	00	00	Valves closed.
80,000	.....	.....	12	00	30	
78,900	.....	.....	12	01	00	
5,000	.....	.....				Released to initial load. Rested one half hour.
5,000	19.72	.....	12	35	00	
68,000	19.76	.....		36	00	
68,200	.....	.....		36	20	
86,400	19.80	.....	12	37	00	
86,220	19.86	.....		38	00	
86,220	19.90	.....		39	00	
87,000	19.96	.004		40	00	Rate of speed increased.
88,300	20.03	.....		41	00	
89,020	20.10	.....		42	00	
91,800	20.21	.....		43	00	
92,100	20.22	.....		44	00	
92,600	20.44	.....		45	00	
93,000	20.55	.....		46	00	
93,400	20.62	.008		47	00	
114,000	.....	.....				Speed of shell increased.
94,500	22.11	.0174	12	59	30	Momentary maximum resistance. After which the resistance fell to about 94,500 pounds and there remained during the continuance of this speed.
75,600	23.19	.....	1	01	20	Under reduced speed.
75,300	23.21	.003	1	02	00	
74,700	23.26	.....	1	03	00	Rate of speed increased.
75,850	23.23	.005		04	00	Do.
77,100	23.41	.007		05	00	Second follower put in machine.

No. 8358—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h.</i>	<i>m.</i>	<i>s.</i>	
5,000	23.41	.....	2	07	00	
70,000	23.47	.....	2	08	10	
74,200	23.49	.008	2	09	00	
78,400	23.60	.009	2	10	00	
77,300	23.79	.016	2	11	00	
78,800	24.02	.019	2	12	00	
80,150	24.26	.020	2	13	00	
88,350	24.55	.024	2	14	00	
88,700	24.91	.030	2	15	00	
83,100	25.64	.061	2	16	00	
76,200	26.57	.....	2	17	00	
75,200	27.39	.069	2	18	00	
75,050	28.27	.....		19	00	
75,200	29.11	.....		20	00	
74,600	30.15	.077	2	21	00	
74,700	30.89	.....		22	00	
76,850	31.74	.066	2	23	00	
75,200	32.63	.....		24	00	
73,500	33.51	.074	2	25	00	
71,500	34.35	.....		26	00	
71,400	35.21	.071	2	27	00	
71,700	36.03	.....		28	00	
71,100	36.79	.....		29	00	
69,200	37.51	.064	2	30	00	
66,500	38.12	.....		31	00	
65,100	38.58	.....		32	00	
65,500	39.06	.....		33	00	
66,200	39.69	.045	2	34	00	
67,300	40.33	.....		35	00	
67,200	41.05	.....		36	00	
67,200	41.77	.058	2	37	09	
66,750	42.39	.....		38	00	
67,600	43.02	.....		39	00	
67,750	43.71	.054	2	40	00	
67,300	44.31	.....		41	00	
66,800	44.87	.....		42	00	
65,100	45.43	.048	2	43	00	
64,500	46.00	.....		44	00	
65,300	46.51	.045	2	45	00	
5,000	46.51	.....	2	57	00	
65,100	46.88	.....		58	00	
64,500	47.81	.....		59	00	
63,300	48.96	.068	3	00	00	
65,500	49.98	.....		01	00	
64,300	50.96	.083	3	02	00	
63,100	51.89	.....		03	00	
61,500	.....	.....		04	00	
60,500	53.55	.072	3	05	00	
59,400	54.40	.....		06	00	
57,050	56.09	.068	3	08	00	
59,900	57.51	.....		10	00	
62,600	59.01	.063	3	12	99	
60,400	60.56	.065	3	14	00	
58,500	61.91	.066		16	00	
61,100	64.01	.087		18	00	
62,800	66.16	.090		20	00	
64,000	.....	.....				Rate increased. Load momentarily reached, then gradually fell to 60,200 pounds.
60,200	68.29	.177	3	21	00	
51,400	68.37	.....		22	00	
52,000	68.40	.....		23	00	
53,200	68.41	.....		24	00	
53,200	68.42	.0025		25	00	
52,700	68.42	.....		26	00	
53,400	68.43	.....		27	00	
53,600	68.44	.....		28	00	
54,100	68.46	.....		29	00	
54,380	68.47	.....		30	00	
54,680	68.47+	.....		31	00	
55,400	68.47+	.....		32	00	
55,900	68.47+	.....		33	00	
55,800	68.49	.....		34	00	
54,850	68.53	.....		35	00	
54,800	68.57	.....		36	00	
55,000	68.61	.....	3	37	00	
55,060	68.65	.....		38	00	

Rate of speed gradually increased.

New stroke of ram taken.

Rate increased.
Load momentarily reached, then gradually
fell to 60,200 pounds.

Slower rate of speed.

Valves gradually opened a slight amount.

Rate increased.

No. 8358—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
57,800	69.20	.005	39 00	Rate increased.
61,100	70.21	.084	40 00	
-----	70.40	-----	-----	Stroke of piston exhausted. New stroke of piston taken.
5,000	70.40	-----	3 48 00	
62,300	71.27	-----	49 00	
67,600	72.02	.067	50 00	
71,200	72.71	.068	51 00	
77,300	73.40	.058	52 00	
77,300	74.02	.052	53 00	
79,200	74.56	.045	54 00	
80,300	75.06	-----	55 00	
82,000	85.50	.039	56 00	
70,300	77.03	.127	57 00	Rate increased, accompanied by immediate drop in resistance. Shell thought to have been in an oblique position in the bore.
50,500	78.80	.147	3 58 00	
0	79.69	.074	59 00	

The metal of the band flowed under the lands of the gun, the copper being forced to the rear about ".20 by each land.

Six sections between lands were fractured just forward of the rear end of the band.

The band generally showed contact with the grooves of the gun, but there were places which did not appear to have reached a bearing at the grooves.

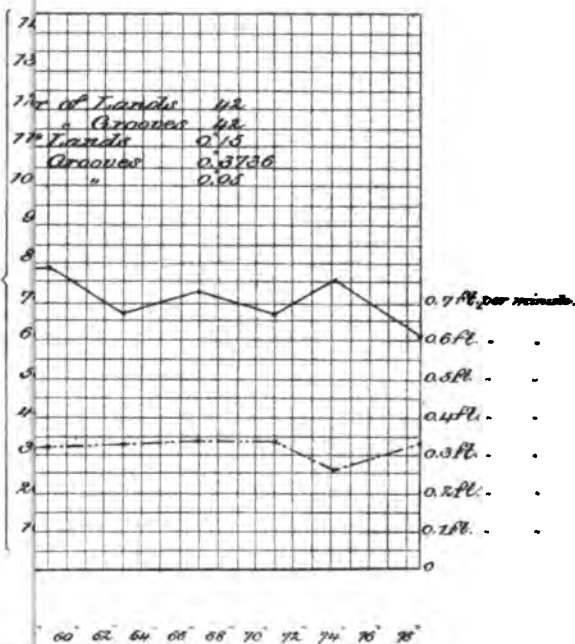
No. 8361.

[Third experiment.]

Shell again rebanded and forced through the gun.

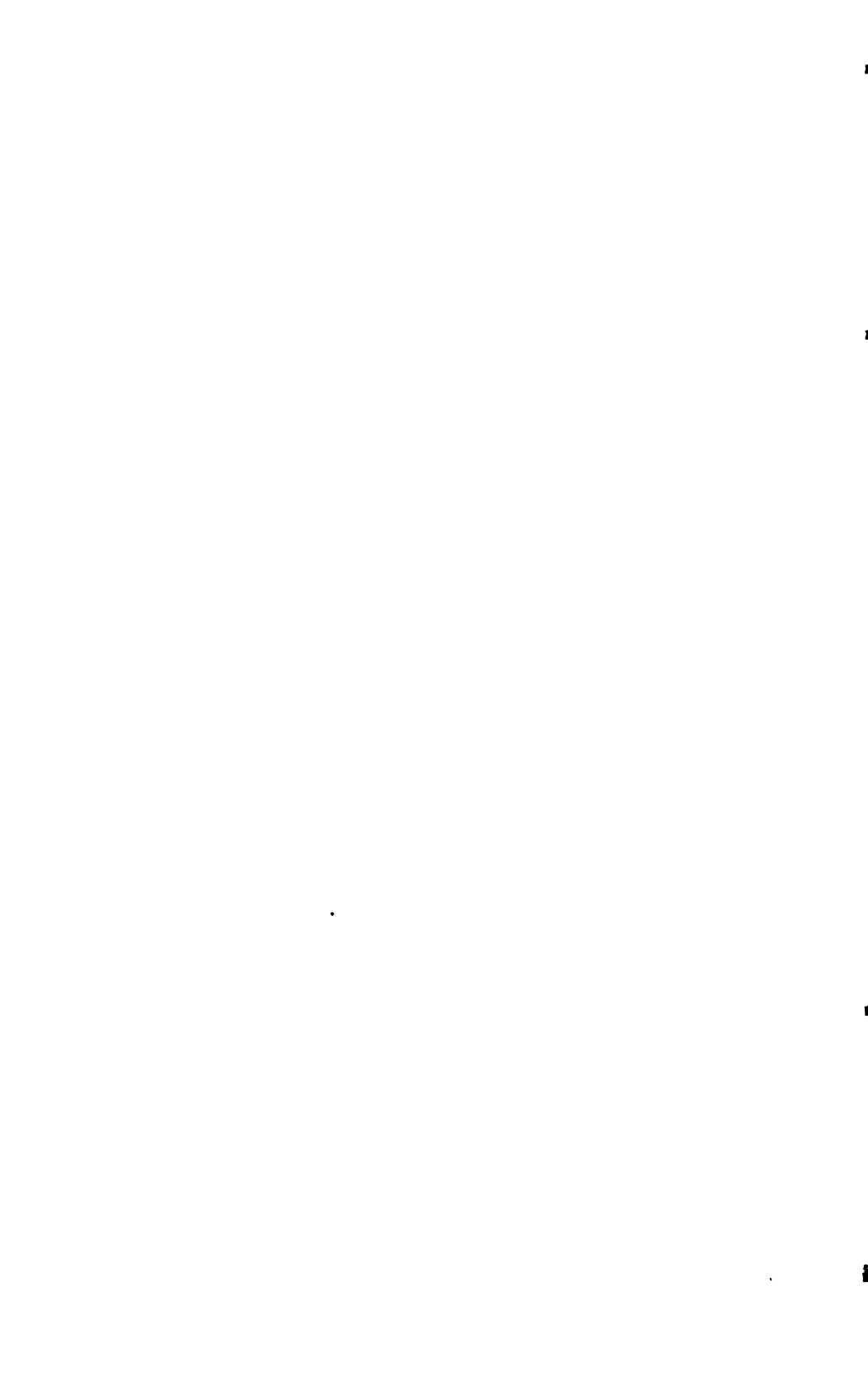
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
5,000	0.	0.	2 10 40	Initial load.
129,000	.80	.200	11 00	Maximum resistance observed
86,000	1.90			
94,000	3.20			
98,000	4.09	.548	2 11 30	
71,600	4.11		2 18 30	Stood at, while ram was pumped up.
108,000	8.15	.577	19 05	Resistance while shell was traveling.
72,600	8.18		2 26 00	Stood at, while ram was pumped up.
112,500	12.30	.736	26 28	Resistance while shell was traveling.
78,000	12.31		2 34 00	Stood at, while ram was pumped up.
101,000				Gradually increased rate of travel of shell.
129,000				Shell began to move freely.
				Resistance gradually increased to 129,000 pounds while under the maximum speed (about 9" per minute), then gradually decreased to 123,000 pounds as the speed was gradually lowered.
123,000	16.38	.839	2 35 00	
92,000	16.43		2 42 00	Stood at, while ram was pumped up.
				Same treatment as last recorded, viz, gradually increased rate of travel of shell.
114,000				When the pressure reached 114,000 pounds the shell was traveling freely.
138,000				The speed was gradually increased until the resistance reached 138,000 pounds, at which time the travel was about the maximum the testing machine will give, or about 9" per minute. The speed was then reduced rather more abruptly than in the preceding observation, the resistance in the meantime falling to 136,000 pounds. This stage of the test occupied 50 seconds.
136,000	20.50	.407	2 42 50	
99,000				
66,500	20.49		3 18 00	Resistance immediately after travel of shell ceased, which was gradually lowered to 66,500 pounds at the time specified.
64,600	20.49		3 20 00	Test resumed at slow speed.
71,600	20.49		3 21 00	
74,800	20.49		22 00	
80,300	20.50		23 00	
85,200	20.50		24 00	
95,000	20.50		25 00	
99,900	20.50		26 00	
101,300	20.50		27 00	
107,500	20.50		28 00	
112,400	20.50		29 00	
115,400	20.50		30 00	
117,400	20.50		31 00	
116,600	20.50		32 00	
115,000	20.51		33 00	
113,800	20.51		34 00	
112,700	20.51		38 00	
112,300	20.51		47 00	
115,700			3 48 00	Valves changed—opened slightly.
115,800			3 49 00	
115,200	20.51		51 30	Valves opened alightly.
119,000	20.52		53 00	
114,900			55 00	
114,000	20.53		3 59 00	As shown by a micrometer, the speed of travel is now ".0022 per minute.
105,000				Load left on the shell.
				Test discontinued.
4,200				Load found on shell after resting about 64 hours. Reduction of load attributed to leakage of oil from straining cylinder through valves.

Total load
on shell.
Lbs.



ing to 1 turn in 25 Cals.
size.





Micrometer attached to gun and compression platform of testing machine.

No. 8361—Continued.

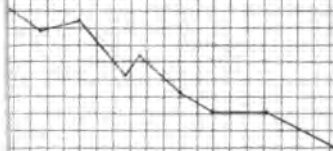
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h. m. s.</i>	
4, 200	0.	.....	8 39 00	
10, 000	.0014	.....	44 00	
10, 000	.0015	.....	45 15	
15, 000	.0028	.....	50 15	
15, 000	.0028	.....	50 30	
20, 000	.0040	.....	55 30	
20, 000	.0040	.....	56 00	
25, 000	.0054	.....	9 03 00	
25, 000	.0054	.....	03 40	
30, 000	.0065	.....	06 40	
30, 000	.0065	.....	13 40	
35, 000	.0078	.....	13 45	
35, 000	.0078	.....	18 45	
40, 000	.0090	.....	19 00	
40, 000	.0091	.....	24 00	
45, 000	.0101	.....	24 30	
45, 000	.0102	.....	29 30	
50, 000	.0118	.....	30 00	
50, 000	.0118	.....	35 00	
55, 000	.0124	.....	35 40	
55, 000	.0124	.....	40 40	
60, 000	.0138	.....	47 50	
60, 000	.0138	.....	52 50	
65, 000	.0148	.....	9 58 20	
65, 000	.0147	.....	58 20	
70, 000	.0157	.....	58 45	
70, 000	.0158	.....	10 03 45	
75, 000	.0168	.....	04 00	
75, 000	.0169	.....	09 00	
80, 000	.0180	.....	09 30	
80, 000	.0180	.....	14 30	
85, 000	.0190	.....	14 40	
85, 000	.0190	.....	19 40	
90, 000	.0200	.....	20 00	
90, 000	.0200	.....	10 25 00	
90, 000	.0180	.....	.....
90, 000	.0140	.....	.....
40, 000	.0096	.....	.....
20, 000	.0049	.....	.....
4, 200	.0012	.....	.....
80, 000	.0180	.....	.....
90, 000	.0200	.....	10 28 40	
95, 000	.0210	.....	33 40	
100, 000	.0218	.....	34 00	
100, 000	.0220	.....	55 30	
105, 000	.0229	.....	56 10	
105, 000	.0229	.....	11 01 10	
110, 000	.0239	.....	11 01 25	
110, 000	.0240	.....	06 25	
115, 000	.0249	.....	06 40	
115, 000	.0250	.....	11 40	
120, 000	.0260	.....	12 05	
120, 000	.0262	.....	17 05	
125, 000	.0273	.....	17 50	
125, 000	.0300	.....	11 22 50	
125, 000	.0450	.....	11 23 50	
115, 000	.0496	.....	11 24 40	Load reduced.
115, 000	.0539	.....	25 40	
110, 000	.0539	.....	11 26 20	Load again reduced.
110, 000	.0542	.....	31 20	
110, 000	.0544	.....	34 20	
110, 000	.0545	.....	39 00	
110, 000	.0545	.....	42 00	
115, 000	.0554	.....	42 45	
115, 000	.0554	.....	43 25	
115, 000	.0557	.....	44 45	
115, 000	.0560	.....	45 45	
115, 000	.0563	.....	46 45	

No. 8361—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	<i>h.</i>	<i>m.</i>	<i>s.</i>	
115,000	.0566	-----		47	45	
115,000	.0570	-----		48	45	
115,000	.0574	-----		49	45	
115,000	.0577	-----		50	45	
115,000	.0580	-----	11	51	45	
115,000	.0584	-----		52	45	
118,000		-----				
118,000	20.56	-----	1	29	00	Test discontinued. Micrometer removed
130,200	20.88	0.053	1	29	30	Test resumed after 1½ hours rest.
132,000	21.25	.062		30	00	
132,200	21.70	.075		30	30	
129,100	22.09	.065		31	00	
121,000	23.42	.111	1	32	00	
	23.75	-----				
5,000	23.75	-----	3	31	15	Total travel.
114,000	24.29	-----		32	00	Second follower put in machine.
108,000	26.00	.107		33	00	
98,400	28.42	.202		34	00	
98,100	31.03	.217		35	00	
93,000	33.80	.231		36	00	
91,100	36.15	.196		37	00	
88,100	39.88	.311		38	00	
87,600	43.47	-----	3	39	00	
84,200	47.13	.366	3	39	50	
5,000	47.13	-----	3	48	40	New stroke of piston taken.
83,000	51.83	.262		50	00	
78,300	55.13	.317		51	00	
78,500	58.93	.317		52	00	
67,700	62.83	.325		53	00	
73,700	66.83	.333		54	00	
67,300	70.81	.332		55	00	
5,000	70.81	-----	4	14	00	New stroke of piston taken.
75,800	73.91	.258		15	00	
61,000	77.81	.325	4	16	00	
						Test completed.

<i>P. Lande:</i>	48
<i>Grasses:</i>	48
<i>Lands:</i>	0.10
<i>Grasses:</i>	0.3229
<i>"</i>	0.06

*Total ton
on sho
Lbs.*



160 165 170 175 180 185 190 195 200 205 210
at 2 Cal. from muzzle.





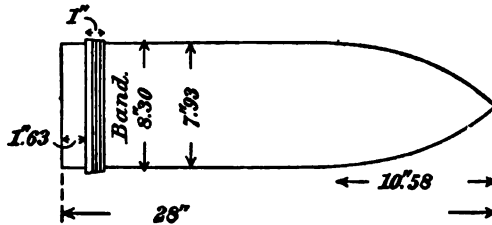
8-INCH B. L. RIFLE—STEEL—14½ TONS.

No. 8371.

Marks on rifle:

“Bethlehem Steel } on trunnion.
Model 1888”

“8-in. No. 7—Wt. 31,915 lbs. (14½ tons), W. B. G. Insp. } on muzzle.
W. P. F. 1893”



Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
<i>Pounds.</i>	<i>Inch.</i>	<i>Foot.</i>	Initial load.
28,350	0.	0.	
42,530	.25	.....
47,840	.50	.....
63,790	.75	.....
92,140	1.00	.....
131,130	1.25	.....
243,120	1.50	.093	
232,130	1.75	.....
208,390	2.00	.....
188,540	2.25	.....
168,340	2.50	.....
168,340	2.75	.093	
175,430	3.00	.....
175,430	3.25	.093	
171,880	3.50	.....
168,340	3.75	.093	
171,880	4.00	.....
175,430	4.25	.....
175,430	4.50	.093	
168,340	4.75	.....
164,800	5.00	.....
168,340	5.25	.....
168,340	5.50	.....
168,340	5.75	.....
168,340	6.00	.093	
159,480	6.25	.....
159,480	6.50	.....
159,480	6.75	.....
159,480	7.00	.....
157,350	7.25	.....
157,350	7.50	.093	
159,480	7.75	.....
159,480	8.00	.....
159,480	8.25	.....
161,610	8.50	.....
161,610	8.75	.....
161,610	9.00	.....
164,800	9.25	.....
164,800	9.50	.....
164,800	9.75	.....
164,800	10.00	.....
164,800	10.25	.093	
161,610	10.50	.....
161,610	10.75	.....
161,250	11.00	.....
159,480	11.25	.....
159,480	11.50	.....
159,480	11.75	.....
159,480	12.00	.....

No. 8371—Continued.

Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	
159, 480	12. 25	.....
159, 480	12. 50	.....
159, 480	12. 75	.....
159, 480	13. 00	.....
158, 060	13. 25	.....
157, 350	13. 50	.....
157, 350	13. 75	.....
155, 940	14. 00	. 093	
157, 350	14. 25	.....
157, 350	14. 50	.....
157, 350	14. 75	.....
157, 350	15. 00	.....
157, 350	15. 25	.....
159, 480	15. 50	.....
161, 610	15. 75	.....
164, 800	16. 00	.....
166, 570	16. 25	.....
170, 110	16. 50	.....
171, 880	16. 75	.....
171, 880	17. 00	.....
171, 880	17. 25	.....
175, 430	17. 50	.....
175, 430	17. 75	. 093	
173, 660	18. 00	.....
171, 880	18. 25	.....
171, 880	18. 50	.....
171, 880	18. 75	.....
171, 880	19. 00	.....
171, 880	19. 25	.....
171, 880	19. 50	. 093	
173, 660	19. 75	.....
173, 660	20. 00	.....
173, 660	20. 25	.....
173, 660	20. 50	.....
175, 430	20. 75	.....
175, 430	21. 00	.....
178, 970	21. 25	.....
178, 970	21. 50	.....
178, 970	21. 75	.....
178, 970	22. 00	.....
181, 450	22. 25	.....
182, 870	22. 50	.....
182, 870	22. 75	.....
182, 870	23. 00	.....
182, 870	23. 25	.....
182, 870	23. 50	.....
186, 060	23. 75	.....
186, 060	24. 00	.....
188, 540	24. 25	.....
188, 540	24. 50	.....
188, 540	24. 75	.....
188, 540	25. 00	.....
186, 060	25. 25	.....
188, 540	25. 50	.....
188, 540	25. 75	.....
188, 540	26. 00	. 093	
186, 060	26. 25	.....
182, 870	26. 50	.....
178, 970	26. 75	.....
173, 660	27. 00	.....
168, 340	27. 25	.....
164, 800	27. 50	.....
164, 800	27. 75	. 093	
168, 340	28. 00	.....
171, 880	28. 25	.....
173, 660	28. 50	.....
175, 430	28. 75	.....
175, 430	29. 00	. 093	
173, 660	29. 25	.....
171, 880	29. 50	.....
171, 880	29. 75	.....
168, 340	30. 00	.....
159, 480	30. 25	.....
161, 610	30. 50	.....
159, 480	30. 75	.....
159, 480	31. 00	.....
157, 350	31. 25	.....

No. 8371—Continued.

Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	
157, 850	31.50	.....
157, 850	31.75	.093	
159, 480	32.00	.....
161, 250	32.25	.....
161, 610	32.50	.....
163, 020	32.75	.....
164, 800	33.00	.....
168, 340	33.25	.....
168, 340	33.50	.....
168, 340	33.75	.093	
166, 570	34.00	.....
168, 340	34.25	.....
168, 340	34.50	.....
168, 340	34.75	.....
168, 340	35.00	.....
166, 570	35.25	.....
168, 340	35.50	.....
166, 570	35.75	.....
164, 800	36.00	.....
164, 800	36.25	.....
164, 800	36.50	.....
164, 800	36.75	.093	
166, 570	37.00	.....
166, 570	37.25	.....
168, 340	37.50	.....
168, 340	37.75	.093	
166, 570	38.00	.....
164, 800	38.25	.....
164, 800	38.50	.....
164, 800	38.75	.....
161, 610	39.00	.....
161, 610	39.25	.....
161, 610	39.50	.....
161, 250	39.75	.....
161, 250	40.00	.....
159, 480	40.50	.....
159, 480	41.00	.....
159, 480	41.50	.....
159, 480	42.00	.....
158, 060	42.50	.....
158, 060	43.00	.....
158, 060	43.50	.093	
159, 480	44.00	.....
161, 250	44.50	.....
161, 610	45.00	.....
161, 610	45.50	.093	
161, 250	46.00	.....
159, 480	46.50	.....
159, 480	47.00	.....
157, 350	47.50	.....
155, 940	48.00	.....
155, 940	48.50	.....
157, 350	49.00	.....
155, 940	49.50	.....
154, 160	50.00	.....
151, 660	50.50	.....
148, 850	51.00	.....
145, 300	51.50	.....
145, 300	52.00	.....
145, 300	52.50	.....
145, 300	53.00	.....
143, 520	53.50	.....
141, 760	54.00	.....
141, 760	54.50	.....
141, 760	55.00	.....
139, 680	55.50	.....
132, 550	56.00	.093	
115, 530	58.00	.093	
111, 280	64.00	.....
109, 150	65.00	.....
108, 450	66.00	.....
109, 150	67.00	.....
108, 450	68.00	.....
108, 060	69.00	.....
106, 320	100.00	.....
106, 450	106.00	.....

No. 8371—Continued.

Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	
101, 360	112.00	Speed reduced slightly. Changed rods. Started.
104, 550	118.00	.....
95, 690	118.00	.....
95, 690	119.00	.....
92, 140	120.00	.....
90, 730	121.00	.....
88, 600	122.00	.....
90, 020	123.00	.....
90, 020	124.00	.....
90, 020	125.00	.....
90, 730	126.00	.....
91, 440	127.00	.....
91, 440	128.00	.....
91, 440	129.00	.....
90, 020	130.00	.....
87, 180	131.00	.....
85, 760	132.00	.093	
86, 120	133.00	.....
88, 600	134.00	.....
90, 730	135.00	.....
91, 790	136.00	.....
92, 140	137.00	.....
92, 140	138.00	.....
90, 370	139.00	.....
87, 180	140.00	.....
85, 760	141.00	.....
81, 510	142.00	.....
79, 350	143.00	.....
78, 680	144.00	.093	
80, 090	145.00	.....
85, 060	146.00	.....
85, 060	147.00	.....
85, 760	148.00	.093	
81, 510	148.00	.....
83, 640	149.00	.....
83, 640	150.00	.....
81, 510	151.00	.....
79, 380	152.00	.....
77, 960	153.00	.....
75, 130	154.00	.....
70, 880	155.00	.....
70, 880	156.00	.....
69, 460	157.00	.....
69, 460	158.00	.....
69, 460	159.00	.093	
70, 880	160.00	.....
70, 880	161.00	.....
70, 880	162.00	.....
71, 590	163.00	.....
71, 590	164.00	.....
72, 300	165.00	.093	
71, 590	166.00	.....
71, 590	167.00	.....
70, 880	168.00	.....
64, 510	169.00	.....
60, 250	170.00	.....
56, 700	171.00	.....
56, 700	172.00	.093	
58, 480	173.00	.....
62, 370	174.00	.093	
60, 960	175.00	.....
60, 250	176.00	.....
60, 250	177.00	.....
60, 250	178.00	.....
58, 480	178.00	.....
55, 290	179.00	.....
51, 740	180.00	.093	
48, 200	181.00	.....
47, 840	182.00	.....
47, 490	183.00	.....
47, 140	184.00	.....
45, 360	185.00	.093	
45, 360	186.00	.....
			Rested.

No. 8371—Continued.

Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	
45, 360	187.00	.....
45, 360	188.00	.....
45, 360	189.00	.....
45, 360	190.00	.....
45, 360	191.00	.....
45, 360	192.00	.....
45, 360	193.00	.....
44, 650	194.00	.....
43, 940	195.00	.093	
44, 300	196.00	.....
44, 300	197.00	.....
44, 300	198.00	.....
44, 300	199.00	.....
42, 530	200.00	.....
41, 520	201.00	.....
34, 730	202.00	.....
35, 440	203.00	.096	Band out.

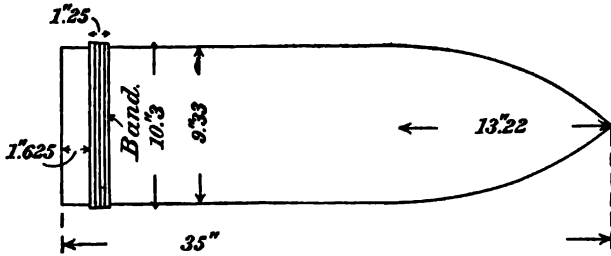
10-INCH B. L. RIFLE—STEEL. 30 TONS.

No. 8504.

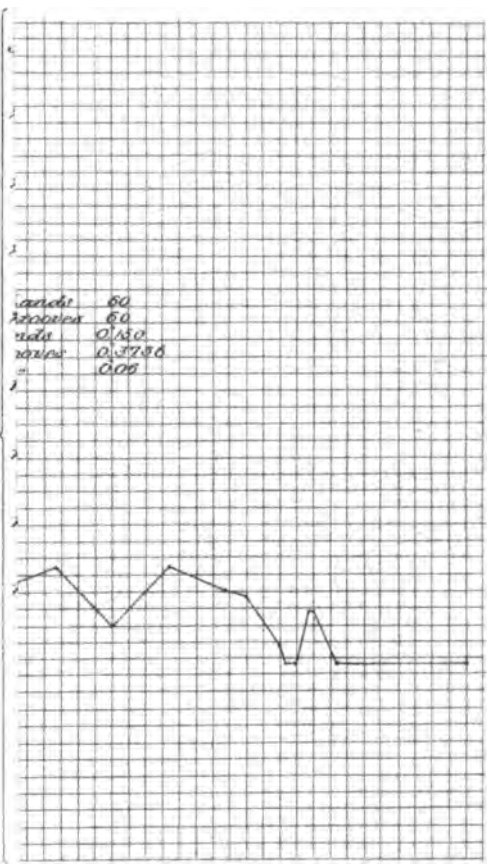
Marks on rifle:

“Bethlehem Steel }
Model 1888.” } on trunnion.

30 tons
“10-in. No. 21, Wt. 67,060 lbs. F. E. H. Insp. }
Watervliet Arsenal, 1894.” } on muzzle.



Resistance.	Distance shell traveled.	Velocity per minute.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	Initial load.
54,680	0.	0.	
57,490	0.50	.....
210,520	1.00	.....
312,770	1.50	.058	
265,200	2.00	.....
191,380	2.50	.....
178,280	3.00	.....
172,790	3.50	.....
171,690	4.00	.....
168,410	4.50	.....
168,410	5.00	.....
168,410	5.50	.058	
171,690	6.00	.....
171,690	6.50	.....
172,790	7.00	.....
172,790	7.50	.....
172,790	8.00	.....
174,980	8.50	.....
174,980	9.00	.....
174,980	9.50	.....
178,280	10.00	.058	
178,280	10.50	.....
178,280	11.00	.....
178,280	11.50	.058	
174,980	12.00	.058	
172,790	12.50	.....
178,280	13.00	.....
178,280	13.50	.....
181,540	14.00	.058	
174,980	14.50	.....
172,790	15.00	.....
172,790	15.50	.....
174,980	16.00	.....
172,790	16.50	.....
172,790	17.00	.058	
178,280	17.50	.....
181,540	18.00	.....
185,810	18.50	.....
185,810	19.00	.....
181,540	19.50	.....
181,540	20.00	.058	
185,810	20.50	.....
185,810	21.00	.....
191,380	21.50	.058	
191,380	22.00	.....
191,380	22.50	.058	

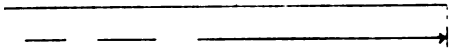


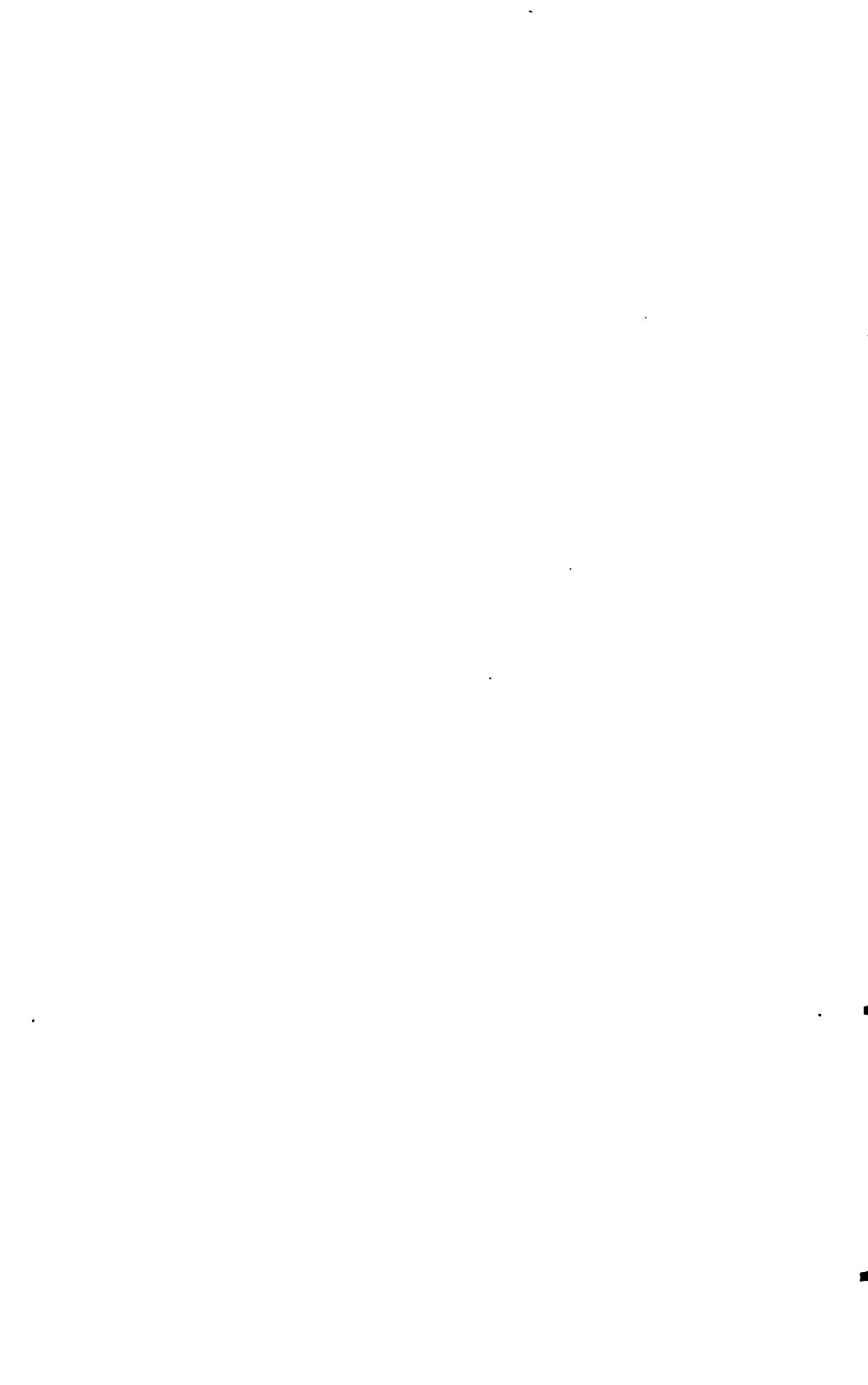
angle 60
stroke 60
rate 0.120
times 0.3750
" 0.05

*Total load
 on shell.
 Lbs.*

104' 116' 128' 140' 152' 164' 176'

from muzzle and uniform.





No. 8504—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	
194, 112	23.00	.....
196, 850	23.50	.....
202, 320	24.00	.053	
204, 500	24.50	.....
206, 600	25.00	.....
202, 320	25.50	.....
202, 320	26.00	.....
202, 320	26.50	.....
202, 320	27.00	.....
202, 320	27.50	.....
202, 320	28.00	.....
204, 500	28.50	.....
204, 500	29.00	.053	
202, 320	29.50	.....
199, 580	30.00	.....
196, 850	30.50	.053	
201, 223	31.00	.....
202, 320	31.50	.....
202, 320	32.00	.....
204, 500	32.50	.....
206, 600	33.00	.053	
215, 440	33.50	.....
210, 520	34.00	.....
217, 626	34.50	.....
218, 720	35.00	.....
219, 810	35.50	.....
219, 810	36.00	.....
224, 188	36.50	.....
226, 920	37.00	.053	
224, 188	37.50	.....
221, 454	38.00	.....
218, 720	38.50	.....
218, 720	39.00	.053	
219, 810	39.50	.....
226, 920	40.00	.....
222, 390	40.50	.....
227, 860	41.00	.....
242, 780	41.50	.053	
242, 780	42.00	.....
237, 800	.....	.....
240, 560	42.50	.....
243, 870	43.00	.....
249, 340	43.50	.....
254, 260	44.00	.....
251, 530	44.50	.....
251, 530	45.00	.....
251, 530	45.50	.053	
249, 340	46.00	.053	
249, 340	47.00	.....
249, 340	48.00	.....
249, 340	49.00	.053	
251, 530	50.00	.....
254, 260	51.00	.....
265, 200	52.00	.053	
265, 200	53.00	.....
265, 200	54.00	.053	
254, 260	55.00	.....
254, 260	56.00	.....
243, 790	57.00	.053	
243, 870	58.00	.....
242, 780	59.00	.....
224, 180	60.00	.053	
224, 180	61.00	.....
221, 450	62.00	.....
218, 720	63.00	.053	
218, 720	64.00	.....
218, 720	65.00	.....
218, 720	66.00	.053	
181, 380	75.00	.053	
184, 110	76.00	.....
191, 380	.....	.....
191, 380	77.00	.....
188, 650	78.00	.053	
188, 910	79.00	.....

New stroke of piston.
Test resumed.

New stroke of piston.
Test resumed.

No. 8504—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Foot.</i>	
178, 260	80.00	.....
178, 260	81.00	.....
191, 380	82.00	.053	
188, 650	83.00	.....
185, 910	84.00	.....
185, 910	85.00	.....
185, 910	86.00	.....
181, 540	87.00	.....
179, 850	88.00	.....
178, 260	89.00	.....
178, 260	90.00	.053	
172, 790	.....	.....	New stroke of piston.
172, 790	91.00	.....	Test resumed.
176, 850	92.00	.053	
191, 380	94.00	.053	
185, 910	100.00	.053	
164, 040	110.00	.053	
153, 100	120.00	.053	
158, 570	130.00	.053	
131, 230	135.00	.058	
122, 480	138.00	.053	
123, 580	139.00	.053	
131, 230	140.00	.....
139, 430	150.00	.058	
115, 920	160.00	.053	
109, 910	170.00	.053	
98, 420	180.00	.053	
98, 420	186.00	.053	
115, 920	.....	.....	New stroke of piston.
109, 360	200.00	.053	Test resumed.
87, 490	210.00	.053	
109, 360	220.00	.053	
101, 160	230.00	.053	
98, 420	234.00	.053	
115, 920	.....	.....	New stroke of piston.
98, 420	235.00	.....	Test resumed.
95, 690	236.00	.....
90, 220	237.00	.....
90, 220	238.00	.....
87, 490	239.00	.....
79, 830	240.00	.085	
73, 820	241.00	.085	
73, 820	242.00	.....
73, 820	243.00	.035	
84, 750	244.00	.....
92, 960	245.00	.035	
92, 960	246.00	.035	
79, 830	247.00	.....
73, 820	248.00	.....
73, 820	249.00	.....
73, 270	250.00	.....
73, 270	270.00	.035	

HELICAL SPRINGS FOR GUN CARRIAGES.



HELICAL SPRINGS FOR GUN CARRIAGES.

Springs consist of nest of three concentric springs each.

DESCRIPTION OF SPRINGS.

	No. 1.	No. 2.
Weight.....	24 lbs. 6 oz.	24 lbs. 9 oz.
Outside coil:		
Diameter of wire.....	1" .12	1" .12
Outside diameter of coil.....	5.95	6.05
Inside diameter of coil.....	3.75	3.76
Middle coil:		
Diameter of wire.....	.75	.75
Outside diameter of coil.....	3.68	3.68
Inside coil:		
Diameter of wire.....	.38	.38
Outside diameter of coil.....	2.01	2.00

COMPRESSION OF SPRINGS.

Applied loads.	No. 8322, spring No. 1.		No. 8323, spring No. 2.	
	Height.	Compression.	Height.	Compression.
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
0	6.17	0.	6.21	0.
500	6.11	.06	6.14	.07
1,000	6.06	.11	6.09	.12
2,000	5.99	.18	6.00	.21
3,000	5.89	.28	5.91	.30
5,000	5.75	.42	5.76	.45
10,000	5.37	.80	5.36	.85
15,000	4.94	1.23	4.97	1.24
10,000	5.29	.88	5.33	.88
5,000	5.67	.50	5.70	.51
1,000	6.04	.13	6.07	.14

Compression of helical springs for 12-inch spring return mortar carriages.

Springs made by the Crescent Steel Company, Pittsburg, Pa.

Four springs placed in the testing machine and closed down with 225,000 pounds.

They were held closed for a period of sixty-four hours. When the load was released to 18,000 pounds the height of the springs was 13" .19.

TESTS OF INDIVIDUAL SPRINGS, WHICH CONSIST OF DOUBLE COILS.

No. 8324.

	Outside coil.	Inside coil.
	<i>Inches.</i>	<i>Inches.</i>
Diameter of wire.....	1.74	1.26
Height.....	13.77	13.70
Distance between coils.....	1.00	.55
Exterior diameter, about.....	8.99	5.47
Interior diameter, about.....	5.56	3.02
Weight..... pounds..	80½	34½

No. 8324—Continued.

Applied loads.	Total height.	Compression.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	
1,500	13.92	0.32	Outside coil in contact with platforms of machine. Inside coil in contact with machine.
2,000	13.54	.38	
2,500	13.48	.44	
3,000	13.43	.49	
3,500	13.37	.55	
4,000	13.32	.60	
4,500	13.27	.65	
5,000	13.23	.69	
6,000	13.14	.78	
7,000	13.04	.88	
8,000	12.95	.97	
9,000	12.87	1.05	
10,000	12.79	1.13	
12,000	12.63	1.29	
14,000	12.49	1.43	
16,000	12.33	1.59	
18,000	12.18	1.74	
20,000	12.04	1.88	
22,000	11.89	2.03	
24,000	11.74	2.18	
26,000	11.59	2.33	
28,000	11.43	2.49	
30,000	11.28	2.64	
32,000	11.11	2.81	
34,000	10.96	2.96	
36,000	10.79	3.13	
38,000	10.61	3.31	
40,000	10.44	3.48	
42,000	10.26	3.66	
44,000	10.09	3.83	
46,000	9.92	4.00	
48,000	9.76	4.16	
50,000	9.63	4.29	
52,000	9.57	4.35	
54,000	9.54	4.38	Inside coil closed down. Outside coil not closed down.
56,000	9.54	4.38+	
54,000	9.54	4.38	
52,000	9.54	4.38	
50,000	9.50	4.33	
48,000	9.67	4.25	
46,000	9.78	4.14	
44,000	9.90	4.02	
42,000	10.04	3.88	
40,000	10.17	3.75	
38,000	10.30	3.62	
36,000	10.46	3.46	
34,000	10.60	3.32	
32,000	10.74	3.18	
30,000	10.88	3.04	
28,000	11.02	2.90	
26,000	11.18	2.74	
24,000	11.33	2.59	
22,000	11.48	2.44	
20,000	11.64	2.28	
18,000	11.79	2.13	
20,000	11.66	2.26	
30,000	10.96	2.96	
40,000	10.23	3.69	
50,000	9.60	4.32	
52,000	9.55	4.37	
54,000	9.54	4.38	
52,000	9.55	4.37	
50,000	9.58	4.34	
40,000	10.16	3.76	
30,000	10.87	3.05	
20,000	11.62	2.30	
18,000	11.78	2.14	
17,000	11.85	2.07	
16,000	11.93	1.99	
15,000	12.02	1.90	
14,000	12.11	1.81	
13,000	12.19	1.73	
12,540	12.25	1.67	
10,000	12.47	1.45	
8,000	12.66	1.26	
6,000	12.87	1.05	

No. 8324—Continued.

Applied loads.	Total height.	Com- pression.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	
4,000	13.11	.81	
2,000	13.36	.56	
4,000	13.16	.76	
6,000	12.98	.94	
8,000	12.80	1.12	
10,000	12.64	1.28	
12,000	12.49	1.43	
14,000	12.34	1.58	
15,000	12.26	1.66	
15.18C	12.25	1.67	
16,000	12.19	1.73	
18,000	12.09	1.83	
50,000	9.60	4.32	
18,000	11.79	2.13	Test discontinued.

COMPRESSION OF THE OUTSIDE COIL OF SPRING No. 8324.

Applied loads.	Total height.	Com- pression.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	
2,000	13.42	0.50	
3,000	13.24	.68	
4,000	13.06	.86	
5,000	12.89	1.03	
6,000	12.71	1.21	
7,000	12.54	1.38	
8,000	12.39	1.53	
9,000	12.23	1.69	
10,000	12.09	1.83	
11,000	11.95	1.97	
12,000	11.80	2.12	
13,000	11.67	2.26	
14,000	11.51	2.41	
15,000	11.38	2.54	
16,000	11.23	2.69	
17,000	11.08	2.84	
18,000	10.93	2.99	
19,000	10.78	3.14	
20,000	10.62	3.30	
21,000	10.47	3.45	
22,000	10.30	3.62	
23,000	10.15	3.77	
24,000	10.00	3.92	
25,000	9.85	4.07	
26,000	9.69	4.23	
26,800	9.56	4.36	
26,000	9.65	4.27	
26,000	9.78	4.14	
24,000	9.89	4.03	
23,000	10.01	3.91	
22,000	10.14	3.78	
21,000	10.28	3.64	
20,000	10.40	3.52	
19,000	10.54	3.38	
18,000	10.68	3.24	
17,000	10.82	3.10	
16,000	10.97	2.95	
15,000	11.10	2.82	
14,000	11.24	2.68	
13,000	11.39	2.53	
12,000	11.52	2.40	
11,000	11.66	2.24	
10,000	11.82	2.10	
9,000	11.97	1.95	
8,000	12.14	1.78	
7,000	12.30	1.62	
6,000	12.48	1.44	
5,000	12.68	1.24	
4,000	12.88	1.04	
3,000	13.08	.84	
2,000	13.30	.62	

COMPRESSION OF THE INSIDE COIL OF SPRING NO. 8324.

Applied loads.	Total height.	Com-pression.	Remarks.
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	
500	13.33	0.27	
1,000	13.21	.39	
2,000	13.03	.57	
3,000	12.88	.72	
4,000	12.72	.88	
5,000	12.57	1.08	
6,000	12.41	1.19	
7,000	12.27	1.33	
8,000	12.11	1.49	
9,000	11.96	1.64	
10,000	11.80	1.80	
11,000	11.65	1.95	
12,000	11.49	2.11	
13,000	11.33	2.27	
14,000	11.17	2.43	
15,000	10.99	2.61	
16,000	10.82	2.78	
17,000	10.64	2.96	
18,000	10.47	3.13	
19,000	10.28	3.32	
20,000	10.08	3.52	
21,000	9.91	3.69	
22,000	9.74	3.86	
22,500	9.66	3.92	
23,000	9.61	3.99	
23,500	9.59	4.33	
23,000	9.60	4.32	
22,000	9.69	3.91	
21,000	9.80	3.80	
20,000	9.93	3.67	
19,000	10.08	3.54	
18,000	10.21	3.39	
17,000	10.37	3.23	
16,000	10.51	3.09	
15,000	10.66	2.94	
14,000	10.81	2.79	
13,000	10.98	2.62	
12,000	11.12	2.48	
11,000	11.28	2.32	
10,000	11.44	2.16	
9,000	11.60	2.00	
8,000	11.77	1.83	
7,000	11.95	1.65	
6,000	12.11	1.49	
5,000	12.30	1.30	
4,000	12.48	1.12	
3,000	12.68	.92	
2,000	12.89	.71	
1,000	13.12	.48	
500	13.24	.36	

RETEST OF 4 SPRINGS WHICH WERE CLOSED DOWN AND KEPT LOADED 64 HOURS.

Applied loads.	Height of springs.			
	First.	Second.	Third.	Fourth.
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
1,000	13.84	13.64	13.67	13.54
16,600				12.25
17,780		12.25		
18,000	12.39	12.23	12.33	12.16
19,350			12.25	
19,970	12.25			
40,000	10.80	10.64	10.68	10.43
50,000	10.04	9.89	9.90	9.79
51,000	9.97	9.83	9.85	9.75
52,000	9.89	9.78	9.81	9.74
53,000	9.82	9.74	9.79	9.72
54,000	9.78	9.72	9.75	9.71
55,000	9.74	9.71	9.73	
56,000	9.72			
57,000	9.71			
52,000	9.83	9.75	9.78	9.72
50,000	9.95	9.83	9.83	9.74
49,000				9.77
48,000				9.80
47,000				9.83
46,000				9.88
45,000				9.92
44,000				9.98
40,000	10.59	10.44	10.43	10.23
18,000	12.14	11.98	12.02	11.84
16,630	12.25			
15,240			12.25	
14,590		12.25		
12,980				12.25
18,000	12.16	12.01	12.06	
40,000	10.67	10.51	10.51	10.31
50,000	9.98	9.85	9.86	9.77
54,000	9.76			
55,000	9.73			
50,000	9.94			
40,000	10.59	10.45	10.46	10.24
18,000	12.12	11.98	12.01	11.82
16,300	12.25			
1,000	13.73			
14,380		12.25		
1,000		13.60		
15,080			12.25	
1,000			13.61	
12,800				12.25
1,000				13.44

TESTS OF SPRINGS NOT PREVIOUSLY LOADED.

Applied loads.	Height of springs.						
	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	Eleventh.
<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
1,000	13.62	13.68	13.90	13.71	13.62	13.43	13.68
16,220						12.25	
17,670					12.25		
18,000	12.26	12.32	12.50	12.34	12.22	12.11	12.31
18,290	12.25						
18,890							12.25
19,150				12.25			
21,550			12.25				
52,500						9.70	
53,500		9.72		9.70			
55,000	9.69				9.70		
56,000			9.69				
62,000							9.59
18,000	12.00	12.03	12.09	12.00	11.92	11.77	11.92
15,900			12.25				
15,080		12.25					
14,740				12.25			
14,620	12.25						
14,000					12.25		
13,940							12.25
^a 12,040						12.25	
^b 12,180						12.25	

^a Load left acting 16 hours.

^b Load necessary to compress spring to 12¹/₂ height at end of 16 hours.


COMPRESSION TESTS OF HELICAL SPRINGS FOR 12-INCH GUN LIFT CARRIAGE.

Springs consist of two coils each, the bars being coiled in opposite directions.

Dimension of springs.

Outside coil:	
Weight.....	pounds.. 13½
Height.....	inches.. 5.40
Exterior diameter.....	do..... 5.79
Diameter of wire.....	do..... 1.00
Distance between coils.....	do..... .50
Inside coil:	
Weight.....	pounds.. 5½
Height.....	inches.. 5.33
Exterior diameter.....	do..... 3.55
Diameter of wire.....	do..... .75
Distance between coils.....	do..... .30

Total weight of spring, 18¾ pounds.

Springs branded { "2 96
A French Spring Co  G E"

Applied loads.	Height of springs.			
	No. 8387.	No. 8388.	No. 8389.	No. 8390.
Pounds.	Inches.	Inches.	Inches.	Inches.
100	5.29	5.30	5.38	5.35
200	5.28	5.27	5.36	5.33
300	5.26	5.24	5.34	5.31
400	5.24	5.21	5.32	5.30
600	5.21	5.19	5.30	5.28
1,000	5.17	5.13	5.26	5.22
2,000	5.05	5.04	5.15	5.11
3,000	4.96	4.95	5.03	5.00
4,000	4.87	4.84	4.94	4.91
5,000	4.76	4.75	4.84	4.80
6,000	4.66	4.65	4.73	4.71
7,000	4.56	4.55	4.63	4.60
8,000	4.45	4.46	4.53	4.50
9,000	4.36	4.36	4.42	4.40
10,000	4.27	4.27	4.32	4.30
11,000	4.17	4.17	4.22	4.20
12,000	4.08	4.11	4.18	4.14
13,000	4.06	4.07	4.16	4.13
14,000	4.05	4.06	4.15	4.12
10,000	4.23	4.22	4.29	4.28
8,000	4.42	4.41	4.48	4.47
6,000	4.60	4.60	4.68	4.66
4,000	4.80	4.80	4.88	4.86
2,000	5.02	5.00	5.10	5.08
1,000	5.14	5.12	5.21	5.19
100	5.29	5.29	5.37	5.33

COMPRESSION TESTS OF HELICAL SPRINGS FOR 7-INCH MORTAR CARRIAGES.

Description of one spring.

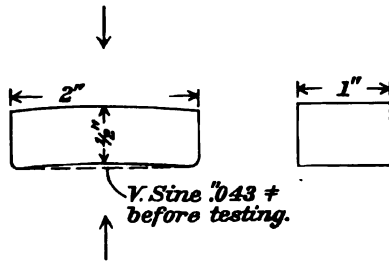
Weight.....	6 lbs. 1½ oz.
Height.....	8".21
Exterior diameter.....	4".41
Interior department.....	3".35
Diameter of wire.....	"".56
Distance between coils.....	"".70

No. of spring.	Height free.	Load sustained.		Height closed.	Load when returned to 6" high.	Remarks.
		When 6" high.	When 4½" high.			
1	Inches. 8.21	Pounds. 856 790	Pounds. 1,700	Inches. 4½	Pounds. 790	
2	8.15	851	1,595	4½	800	Second application of load.
3	8.25	910	1,700	4½	866	
4	8.15	862	1,655	4½	810	
5	8.08	812	1,750	4½	795	
6	8.13	836		4.15	795	
7	8.12	804	1,700	4½	798	
8	8.20	838	1,650	4½	792	
9	8.23	892	1,680	4½	870	
10	8.27	884	1,800	4½	842	
11	8.56	956	1,750	4½	854	
12	8.22	896	1,790	4½	876	
		778				
13	8.25	839	1,650	4½	802	Spring compressed to 4".25 height ten times, releasing to 6" height between each loading; then recovered to 776 pounds.
					776	After 10 additional compressions as above.
					766	

Spring No. 13 was now closed down, and thus remained a period of 15 hours. When released to 6" high it sustained 746 pounds. Load released and immediately reapplied. The spring when 6" high now sustained 788 pounds.

COMPRESSION TESTS OF STEEL SPRINGS.

No. 8362.

Tool steel.

Under 73,100 pounds compression the spring was nearly closed down; light barely perceptible between spring and buttress. Under 95,400 pounds compression the spring was fully closed down.

V. sine after loading once as above, ".027."

Loaded with 95,400 pounds compression ten times, after which the V. sine was ".023, thus showing a permanent set of ".020.

No. 8367.

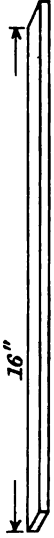
Spring steel.

V. sine before testing, ".04.

Under 60,800 pounds the spring fractured. There were two principal fragments and four smaller ones.

The fractures were fine granular.

STEEL PLATE FROM BERLIN IRON BRIDGE COMPANY.



No. of test.	Dimensions in inches.		Sec-tional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Con-traction of area.	Appearance of fracture.	Elongation of inch sections.
	Width.	Thick-ness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
9337	0.993	0.245	Sq. in. 0.245	Pounds. 10,140	Pounds. 14,410	Pounds. 59,300	2.08	25.4	"	72 x 14 = 101	Per cent. 59.4	SILKY	"
9338	.990	.249	0.246	10,020	14,310	58,170	2.11	26.4	"	70 x 15 = 105	57.3	do	"
9339	.996	.381	.379	16,180	23,880	61,690	2.07	26.9	"	70 x 23 = 161	57.5	SILKY; seamy surface	"
9340	.996	.380	.378	15,990	23,120	61,160	2.83	29.1	"	70 x 24 = 168	55.5	SILKY	"
9341	1.003	.488	.487	19,150	29,940	61,480	2.27	28.4	"	68 x 28 = 190	61.0	do	"
9342	1.001	.484	.484	19,580	29,700	61,380	2.12	28.5	"	67 x 30 = 201	58.4	do	"
9343	.996	.714	.711	19,100	38,860	53,560	2.68	33.5	"	64 x 36 = 230	67.7	do	"
9344	1.011	.714	.722	18,860	38,060	52,700	2.40	30.0	"	60 x 40 = 240	66.8	do	"

CAST IRON
FROM
WATERTOWN ARSENAL FOUNDRY.

CUPOLA IRON.



CAST IRON FROM WATERTOWN ARSENAL FOUNDRY—CUPOLA IRON.

The mixtures for the following specimens, five experimental casts, consisted of steel scrap, a soft pig iron, and an alloy added for the purpose of producing the desired chemical composition.

Specimens Nos. 5250, 5253, and 5254 from these heats, were poured before the alloy was added.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.	
September 12, 1895	Steel scrap	1,200	Cupola	{ 5249 5250 5463
	Soft pig	1,800		
	Total	3,000		
September 14, 1895	Steel scrap ..	1,320	Cupola	{ 5253 5464
	Soft pig	1,800		
	Total	3,120		
September 17, 1895	Steel scrap	2,000	Cupola	{ 5254 5465
	Siloon pig	200		
	Total	2,200		
September 19, 1895	Steel scrap	1,200	Cupola	5466
	Soft pig	1,800		
	Total	3,000		
September 25, 1895	Steel scrap	2,000	Cupola	{ 5255 5467
	Watervliet pig	3,000		
	Total	5,000		

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 12, 1895.

No. 5463.

Marks, No. 837.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00007	.00007			
3,000	3,000	.00010	.00003			
4,000	4,000	.00016	.00006			
5,000	5,000	.00021	.00005	0.		
6,000	6,000	.00028	.00007			
7,000	7,000	.00035	.00007			
8,000	8,000	.00040	.00005			
9,000	9,000	.00048	.00008			
10,000	10,000	.00053	.00005	0.		
11,000	11,000	.00061	.00008			
12,000	12,000	.00070	.00009			
13,000	13,000	.00079	.00009			
14,000	14,000	.00087	.00008			
15,000	15,000	.00098	.00011			
16,000	16,000	.00107	.00009			
17,000	17,000	.00119	.00012			
18,000	18,000	.00130	.00011			
19,000	19,000	.00144	.00014			
20,000	20,000	.00161	.00017			
21,000	21,000	.00179	.00018			
22,000	22,000	.00200	.00021			
23,000	23,000	.00228	.00028			
24,000	24,000	.00260	.00032			
25,000	25,000	.00290	.00030			
26,000	26,000	.00335	.00045			
26,980	26,980	-----	-----	-----	-----	Tensile strength.

Fractured at the neck. Appearance fine granular, gray.
Specific gravity, 7.2326.

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 14, 1895.

No. 5464.

Marks, No. 838.
 Diameter, 1".129.
 Sectional area, 1 square inch.
 Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000	1,000	0.	0.			Initial load.
2,000	2,000	.00005	.00005			
3,000	3,000	.00010	.00005			
4,000	4,000	.00015	.00005			
5,000	5,000	.00021	.00006	— .00001	— .00001	
6,000	6,000	.00026	.00005			
7,000	7,000	.00033	.00007			
8,000	8,000	.00038	.00005			
9,000	9,000	.00045	.00007			
10,000	10,000	.00052	.00007	0.	.00001	
11,000	11,000	.00059	.00007			
12,000	12,000	.00067	.00008			
13,000	13,000	.00076	.00008			
14,000	14,000	.00083	.00007			
15,000	15,000	.00091	.00008	.00009	.00008	
16,000	16,000	.00101	.00010			
17,000	17,000	.00111	.00010			
18,000	18,000	.00122	.00011			
19,000	19,000	.00135	.00013			
20,000	20,000	.00150	.00015	.00024	.00016	
21,000	21,000	.00168	.00018			
22,000	22,000	.00182	.00014			
23,000	23,000	.00200	.00018			
24,000	24,000	.00230	.00030			
25,000	25,000	.00255	.00025	.00083	.00059	
26,000	26,000	.00299	.00044			
27,000	27,000	.00341	.00042			
28,000	28,000	.00400	.00059			
29,000	29,000	.00468	.00068			
30,000	30,000	.00590	.00092	.00325	.00242	
5,000	5,000	.00350	— .00210			
10,000	10,000	.00387	.00037			
15,000	15,000	.00425	.00038			
20,000	20,000	.00467	.00042			
25,000	25,000	.00511	.00044			
20,000	20,000	.00477	— .00034			
15,000	15,000	.00440	— .00037			
10,000	10,000	.00400	— .00040			
5,000	5,000	.00360	— .00040	.00323	— .00002	
30,000	30,000					Tensile strength.

Fractured at the neck. Appearance fine granular, mottled.
 Specific gravity, 7.2380.

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 17, 1895.

No. 5465.

Marks, No. 839.

Diameter, 1".129.

Sectional area, 1 square inch.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00005	.00005	-----	-----	
3,000	3,000	.00009	.00009	-----	-----	
4,000	4,000	.00014	.00005	-----	-----	
5,000	5,000	.00019	.00005	0.	-----	
6,000	6,000	.00023	.00004	-----	-----	
7,000	7,000	.00030	.00007	-----	-----	
8,000	8,000	.00035	.00005	-----	-----	
9,000	9,000	.00039	.00004	-----	-----	
10,000	10,000	.00045	.00006	0.	-----	
11,000	11,000	.00049	.00004	-----	-----	
12,000	12,000	.00055	.00006	-----	-----	
13,000	13,000	.00060	.00005	-----	-----	
14,000	14,000	.00067	.00007	-----	-----	
15,000	15,000	.00071	.00004	.00003	.00003	
16,000	16,000	.00079	.00008	-----	-----	
17,000	17,000	.00085	.00006	-----	-----	
18,000	18,000	.00090	.00005	-----	-----	
19,000	19,000	.00098	.00008	-----	-----	
20,000	20,000	.00104	.00006	.00009	.00006	
21,000	21,000	.00111	.00007	-----	-----	
22,000	22,000	.00119	.00008	-----	-----	
23,000	23,000	.00128	.00009	-----	-----	
24,000	24,000	.00135	.00007	-----	-----	
25,000	25,000	.00144	.00009	.00020	.00011	
26,000	26,000	.00154	.00010	-----	-----	
27,000	27,000	.00165	.00011	-----	-----	
28,000	28,000	.00178	.00013	-----	-----	
29,000	29,000	.00189	.00011	-----	-----	
30,000	30,000	.00204	.00015	.00048	.00028	
31,000	31,000	.00221	.00017	-----	-----	
32,000	32,000	.00241	.00020	-----	-----	
33,000	33,000	.00262	.00021	-----	-----	
34,000	34,000	.00288	.00026	-----	-----	
35,000	35,000	.00319	.00031	.00124	.00076	
37,620	37,620	-----	-----	-----	-----	

Fractured at the neck. Appearance fine granular, granitic.
Specific gravity, 7.3455.

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 19, 1895.

No. 5466.

Marks, No. 840.
 Diameter, 1".129.
 Sectional area, 1 square inch.
 Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006			
3,000	3,000	.00011	.00005			
4,000	4,000	.00017	.00006			
5,000	5,000	.00021	.00004	0.		
6,000	6,000	.00028	.00007			
7,000	7,000	.00035	.00007			
8,000	8,000	.00041	.00006			
9,000	9,000	.00047	.00006			
10,000	10,000	.00053	.00006	.00002	.00002	
11,000	11,000	.00061	.00008			
12,000	12,000	.00070	.00009			
13,000	13,000	.00078	.00008			
14,000	14,000	.00086	.00008			
15,000	15,000	.00093	.00007	.00010	.00008	
16,000	16,000	.00103	.00010			
17,000	17,000	.00113	.00010			
18,000	18,000	.00122	.00009			
19,000	19,000	.00137	.00015			
20,000	20,000	.00150	.00013	.00029	.00019	
21,000	21,000	.00166	.00016			
22,000	22,000	.00182	.00016			
23,000	23,000	.00205	.00023			
24,000	24,000	.00230	.00025			
25,000	25,000	.00254	.00024	.00090	.00061	
26,000	26,000	.00280	.00026			
27,000	27,000	.00325	.00045	.00141	.00051	
31,990	31,990					Tensile strength.

Fractured at the neck. Appearance fine granular, light gray.
 Specific gravity, 7.2241.

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STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 25, 1895.

No. 5467.

Marks, No. 842.

Diameter, 1".129.

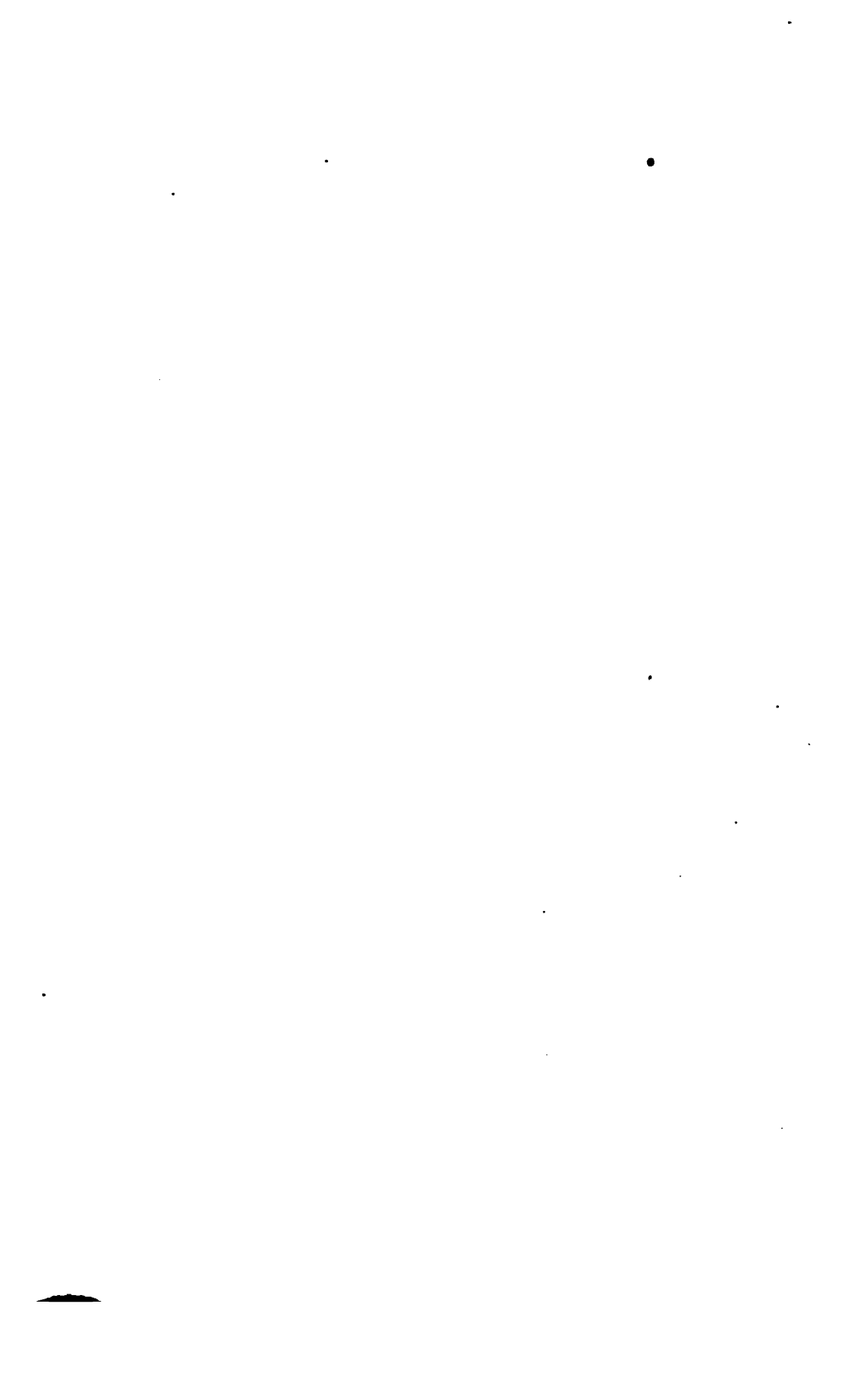
Sectional area, 1 square inch.

Gauged length, 10".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00008	.00008			
3,000	3,000	.00012	.00004			
4,000	4,000	.00018	.00006			
5,000	5,000	.00022	.00004	0.		
6,000	6,000	.00028	.00006			
7,000	7,000	.00033	.00005			
8,000	8,000	.00038	.00005			
9,000	9,000	.00043	.00005			
10,000	10,000	.00048	.00005	.00001	.00001	
11,000	11,000	.00053	.00005			
12,000	12,000	.00058	.00005			
13,000	13,000	.00063	.00005			
14,000	14,000	.00069	.00006			
15,000	15,000	.00075	.00006	.00006	.00005	
16,000	16,000	.00080	.00005			
17,000	17,000	.00088	.00008			
18,000	18,000	.00093	.00005			
19,000	19,000	.00099	.00006			
20,000	20,000	.00104	.00005	.00008	.00002	
20,000	20,000					Tensile strength.

Fractured at the neck. Appearance fine granular, light granitic. Fractured on the second application of load after determining the permanent set caused by the first loading.

CAST IRON
FROM
WATERTOWN ARSENAL FOUNDRY
AND
PIG IRONS.



CAST IRON FROM WATERTOWN ARSENAL FOUNDRY AND PIG IRONS.

The specimens of cast iron were taken from cylinders 18 inches long by 8 inches diameter, cored 3½ inches in diameter, poured from the same metal as the castings they represented.

Specimens of pig iron were turned down directly from sample pigs.

The furnace charges were as follows:

The heads referred to in the furnace charges were heads of shell from previous casts.

The scrap iron used was old shot and shell, bolsters, and gun-carriage scrap of good quality.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.
	<p style="text-align: right;"><i>Pounds.</i></p> Muirkirk pig No. 4, high 4,000 Muirkirk pig No. 4, low 4,000 Katahdin pig 4,000 Soft pig 5,000 Remelted pig 5,000 Total 22,000	Air furnace.....	
July 2, 1895	Muirkirk pig No. 4, high 3,000 Muirkirk pig No. 4, low 3,000 Katahdin pig 1,500 Waterville pig 5,000 Heads 3,500 10-inch shell 3,500 Scrap 1,000 Total 20,500	Cupola	5225
July 8, 1895	Muirkirk pig No. 4, high 1,800 Muirkirk pig No. 4, low 1,800 Katahdin pig 1,200 Waterville pig 4,000 Heads 5,000 10-inch shell 2,000 Scrap 3,000 Total 18,800	..do	5226
July 12, 1895	Muirkirk pig No. 4, high 1,800 Muirkirk pig No. 4, low 1,800 Katahdin pig 1,200 Waterville pig 4,000 Heads 3,000 10-inch shell 2,000 Scrap 3,000 Total 16,800	..do	5227
July 17, 1895	Muirkirk pig No. 4, high 1,800 Muirkirk pig No. 4, low 1,800 Katahdin pig 1,200 Waterville pig 4,000 Heads 3,000 10-inch shell 3,000 Scrap 3,200 Total 18,000	..do	5228

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.		
	<i>Pounds.</i>				
July 25, 1895	Muirkirk pig No. 4, high	600			
	Muirkirk pig No. 4, low	600			
	Katahdin pig	1,200			
	Watervliet pig	2,000			
	Heads	3,000	Cupola	5230	
	10-inch shell	2,000			
	Scrap	3,600			
Total	13,000				
July 30, 1895	Muirkirk pig No. 4, high	1,800			
	Muirkirk pig No. 4, low	1,200			
	Watervliet pig	2,500			
	Heads	3,000	do	5231	
	10-inch shell	3,000			
	Scraps	2,500			
Total	14,000				
August 3, 1895	Muirkirk pig No. 4, low	1,800			
	Katahdin pig	1,200			
	Watervliet pig	2,500			
	Heads	2,500	do	5232	
	10-inch shell	2,500			
	Scrap	2,500			
Total	13,000				
August 8, 1895	Muirkirk pig No. 4, low	2,400			
	Katahdin pig	1,200			
	Watervliet pig	3,500			
	Platform scrap	6,000			
	Heads	2,500	do	5237	
	10-inch shell	2,500			
	Scrap	1,500			
Total	19,000				
August 13, 1895	Muirkirk pig No. 4, low	1,800			
	Katahdin pig	1,200			
	Watervliet pig	2,500			
	Heads	2,500	do	5240	
	10-inch shell	2,000			
	Scrap	1,000			
	Total	11,000			
August 19, 1895	Muirkirk pig No. 4, low	1,800			
	Katahdin pig	1,200			
	Watervliet pig	2,500			
	Heads	2,500	do	5242	
	10-inch shell	2,000			
	Scrap	1,000			
	Total	11,000			
August 23, 1895	Muirkirk pig No. 4, low	1,800			
	Katahdin pig	1,200			
	Watervliet pig	2,000			
	Heads	2,500	do	5243	
	10-inch shell	2,500			
	Scrap	2,000			
	Total	12,000			
August 28, 1895	Muirkirk pig No. 4, low	1,800			
	Katahdin pig	1,000			
	Watervliet pig	2,000			
	Heads	2,500	do	5244	
	10-inch shell	2,500			
	Total	9,800			
September 7, 1895	Muirkirk pig No. 4, low	2,000			
	Katahdin pig	1,500			
	Watervliet pig	3,000			
	Heads	3,000	do	5248	
	10-inch shell	2,000			
	Scrap	500			
	Total	12,000			

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.														
September 30, 1895.	<table border="0"> <tr><td></td><td style="text-align: right;"><i>Pounds.</i></td></tr> <tr><td>Muirkirk pig No. 4, low</td><td style="text-align: right;">2,000</td></tr> <tr><td>Watervliet pig</td><td style="text-align: right;">2,500</td></tr> <tr><td>Heads</td><td style="text-align: right;">2,500</td></tr> <tr><td>10-inch shell</td><td style="text-align: right;">3,000</td></tr> <tr><td>Scrap</td><td style="text-align: right;">2,000</td></tr> <tr><td>Total</td><td style="text-align: right;">12,000</td></tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, low	2,000	Watervliet pig	2,500	Heads	2,500	10-inch shell	3,000	Scrap	2,000	Total	12,000	Cupola.....	5257
		<i>Pounds.</i>															
	Muirkirk pig No. 4, low	2,000															
	Watervliet pig	2,500															
	Heads	2,500															
10-inch shell	3,000																
Scrap	2,000																
Total	12,000																
October 3, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, low</td><td style="text-align: right;">1,500</td></tr> <tr><td>Watervliet pig</td><td style="text-align: right;">3,500</td></tr> <tr><td>Heads</td><td style="text-align: right;">1,500</td></tr> <tr><td>10-inch shell</td><td style="text-align: right;">1,000</td></tr> <tr><td>Scrap</td><td style="text-align: right;">2,500</td></tr> <tr><td>Total</td><td style="text-align: right;">10,000</td></tr> </table>	Muirkirk pig No. 4, low	1,500	Watervliet pig	3,500	Heads	1,500	10-inch shell	1,000	Scrap	2,500	Total	10,000do	5258		
	Muirkirk pig No. 4, low	1,500															
	Watervliet pig	3,500															
	Heads	1,500															
	10-inch shell	1,000															
Scrap	2,500																
Total	10,000																
October 16, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, low</td><td style="text-align: right;">1,000</td></tr> <tr><td>Watervliet pig</td><td style="text-align: right;">3,500</td></tr> <tr><td>Heads</td><td style="text-align: right;">8,000</td></tr> <tr><td>10-inch shell</td><td style="text-align: right;">2,500</td></tr> <tr><td>Total</td><td style="text-align: right;">10,000</td></tr> </table>	Muirkirk pig No. 4, low	1,000	Watervliet pig	3,500	Heads	8,000	10-inch shell	2,500	Total	10,000do	5280				
	Muirkirk pig No. 4, low	1,000															
	Watervliet pig	3,500															
	Heads	8,000															
	10-inch shell	2,500															
Total	10,000																
October 25, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, low</td><td style="text-align: right;">800</td></tr> <tr><td>Watervliet pig</td><td style="text-align: right;">1,400</td></tr> <tr><td>Soft pig</td><td style="text-align: right;">1,000</td></tr> <tr><td>Scrap</td><td style="text-align: right;">9,000</td></tr> <tr><td>Total</td><td style="text-align: right;">12,000</td></tr> </table>	Muirkirk pig No. 4, low	800	Watervliet pig	1,400	Soft pig	1,000	Scrap	9,000	Total	12,000do	5262				
	Muirkirk pig No. 4, low	800															
	Watervliet pig	1,400															
	Soft pig	1,000															
	Scrap	9,000															
Total	12,000																
November 5, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, high</td><td style="text-align: right;">1,000</td></tr> <tr><td>Muirkirk pig No. 4, low</td><td style="text-align: right;">1,000</td></tr> <tr><td>Watervliet pig</td><td style="text-align: right;">2,000</td></tr> <tr><td>Heads</td><td style="text-align: right;">2,000</td></tr> <tr><td>Scrap</td><td style="text-align: right;">6,000</td></tr> <tr><td>Total</td><td style="text-align: right;">12,000</td></tr> </table>	Muirkirk pig No. 4, high	1,000	Muirkirk pig No. 4, low	1,000	Watervliet pig	2,000	Heads	2,000	Scrap	6,000	Total	12,000do	5264		
	Muirkirk pig No. 4, high	1,000															
	Muirkirk pig No. 4, low	1,000															
	Watervliet pig	2,000															
	Heads	2,000															
Scrap	6,000																
Total	12,000																
November 15, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, high</td><td style="text-align: right;">2,000</td></tr> <tr><td>Watervliet pig</td><td style="text-align: right;">3,000</td></tr> <tr><td>Heads</td><td style="text-align: right;">3,000</td></tr> <tr><td>10-inch shell</td><td style="text-align: right;">2,000</td></tr> <tr><td>Scrap</td><td style="text-align: right;">2,000</td></tr> <tr><td>Total</td><td style="text-align: right;">12,000</td></tr> </table>	Muirkirk pig No. 4, high	2,000	Watervliet pig	3,000	Heads	3,000	10-inch shell	2,000	Scrap	2,000	Total	12,000do	5265		
	Muirkirk pig No. 4, high	2,000															
	Watervliet pig	3,000															
	Heads	3,000															
	10-inch shell	2,000															
Scrap	2,000																
Total	12,000																
November 23, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, high</td><td style="text-align: right;">1,000</td></tr> <tr><td>Watervliet pig</td><td style="text-align: right;">1,000</td></tr> <tr><td>Heads</td><td style="text-align: right;">2,000</td></tr> <tr><td>Scrap</td><td style="text-align: right;">11,000</td></tr> <tr><td>Total</td><td style="text-align: right;">15,000</td></tr> </table>	Muirkirk pig No. 4, high	1,000	Watervliet pig	1,000	Heads	2,000	Scrap	11,000	Total	15,000do	5267				
	Muirkirk pig No. 4, high	1,000															
	Watervliet pig	1,000															
	Heads	2,000															
	Scrap	11,000															
Total	15,000																
December 5, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, low</td><td style="text-align: right;">500</td></tr> <tr><td>Heads</td><td style="text-align: right;">1,500</td></tr> <tr><td>10-inch shell</td><td style="text-align: right;">1,500</td></tr> <tr><td>Scrap</td><td style="text-align: right;">10,500</td></tr> <tr><td>Total</td><td style="text-align: right;">14,000</td></tr> </table>	Muirkirk pig No. 4, low	500	Heads	1,500	10-inch shell	1,500	Scrap	10,500	Total	14,000do	5286				
	Muirkirk pig No. 4, low	500															
	Heads	1,500															
	10-inch shell	1,500															
	Scrap	10,500															
Total	14,000																
December 7, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, low</td><td style="text-align: right;">2,500</td></tr> <tr><td>Muirkirk pig No. 4, high</td><td style="text-align: right;">2,500</td></tr> <tr><td>Heads</td><td style="text-align: right;">3,000</td></tr> <tr><td>10-inch shell</td><td style="text-align: right;">3,000</td></tr> <tr><td>Watervliet pig</td><td style="text-align: right;">2,000</td></tr> <tr><td>Scrap</td><td style="text-align: right;">4,000</td></tr> <tr><td>Total</td><td style="text-align: right;">17,000</td></tr> </table>	Muirkirk pig No. 4, low	2,500	Muirkirk pig No. 4, high	2,500	Heads	3,000	10-inch shell	3,000	Watervliet pig	2,000	Scrap	4,000	Total	17,000do	5287
	Muirkirk pig No. 4, low	2,500															
	Muirkirk pig No. 4, high	2,500															
	Heads	3,000															
	10-inch shell	3,000															
Watervliet pig	2,000																
Scrap	4,000																
Total	17,000																
December 12, 1895.....	<table border="0"> <tr><td>Muirkirk pig No. 4, low</td><td style="text-align: right;">3,000</td></tr> <tr><td>Heads</td><td style="text-align: right;">3,000</td></tr> <tr><td>10-inch shell</td><td style="text-align: right;">3,000</td></tr> <tr><td>Soft pig</td><td style="text-align: right;">500</td></tr> <tr><td>Scrap</td><td style="text-align: right;">4,500</td></tr> <tr><td>Total</td><td style="text-align: right;">14,000</td></tr> </table>	Muirkirk pig No. 4, low	3,000	Heads	3,000	10-inch shell	3,000	Soft pig	500	Scrap	4,500	Total	14,000do	5288		
	Muirkirk pig No. 4, low	3,000															
	Heads	3,000															
	10-inch shell	3,000															
	Soft pig	500															
Scrap	4,500																
Total	14,000																

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.
December 27, 1895	Muirkirk pig No. 4, high	Cupola	5292 5293
	Muirkirk pig No. 4, low		
	Heads		
	Scrap		
	Total		
December 31, 1895	Muirkirk pig No. 4, high	do	5295
	Muirkirk pig No. 4, low		
	Heads		
	10-inch shell		
	Scrap		
January 4, 1896	Muirkirk pig No. 4, high	do	5296
	Muirkirk pig No. 4, low		
	Heads		
	10-inch shot		
	Scrap		
January 11, 1896	Muirkirk pig No. 4, high	do	5298
	Muirkirk pig No. 4, low		
	Heads		
	10-inch shell		
	Scrap		
January 20, 1896	Muirkirk pig No. 4, high	do	5301
	Muirkirk pig No. 4, low		
	Soft pig		
	Heads		
	10-inch shell		
January 23, 1896	Muirkirk pig No. 4, high	do	5302
	Muirkirk pig No. 4, low		
	Soft pig		
	Heads		
	10-inch shell		
January 27, 1896	Muirkirk pig No. 4, high	do	5304
	Muirkirk pig No. 4, low		
	Soft pig		
	Heads		
	10-inch shell		
January 30, 1896	Muirkirk pig No. 4, high	do	5308
	Muirkirk pig No. 4, low		
	Soft pig		
	Heads		
	10-inch shell		
February 3, 1896	Muirkirk pig No. 4, high	do	5309
	Muirkirk pig No. 4, low		
	Soft pig		
	Heads		
	10-inch shell		
	Scrap		
	Total		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.
	<i>Pounds.</i>		
	Muirkirk pig No. 4, high	Air furnace	
	Muirkirk pig No. 4, low		
	Soft pig		
	Remelted pig.....		
	Total.....		
February 6, 1896	Muirkirk pig No. 4, high	Cupola	5316
	Muirkirk pig No. 4, low		
	Soft pig		
	Heads		
	10-inch shell		
	Scrap		
	Total.....		5317
February 10, 1896	Muirkirk pig No. 4, high	do	5319
	Muirkirk pig No. 4, low		
	Soft pig		
	Heads		
	10-inch shell		
	Scrap		5320
	Total.....		
February 20, 1896	Muirkirk pig.....	do	5323
	Soft pig		
	Heads		
	10-inch shell		
	Scrap		
	Total.....		
February 25, 1896	Muirkirk pig No. 4, low	do	5324
	Salisbury pig No. 4, high		
	Soft pig		
	Heads		
	10-inch shell		
	Scrap		5325
	Total.....		
March 3, 1896	Salisbury pig No. 4, high	do	5328
	Salisbury pig No. 4, low		
	Soft pig		
	Heads		
	12-inch shell		
	Scrap		5333
	Total.....		
March 10, 1896	Salisbury pig No. 4, high	do	5334
	Salisbury pig No. 4, low		
	Soft pig		
	Heads		
	10-inch shell		
	Scrap		5325
	Total.....		
March 13, 1896	Muirkirk pig No. 4, high	do	5336
	Salisbury pig No. 4, high		
	Salisbury pig No. 4, low		
	Soft pig		
	Heads		
	Scrap		
	10-inch shell		
	Total.....		
March 27, 1896	Salisbury pig No. 4, high	do	5340
	Salisbury pig No. 4, low		
	Heads		
	10-inch shell		
	Scrap		
	Total.....		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.	
August 16, 1895	<i>Pounds.</i>	Air furnace	5241	
	Muirkirk pig No. 4, high			3,600
	Muirkirk pig No. 4, low			3,600
	Katabdin pig			3,600
	Soft pig			3,600
	Remelted pig			3,600
Total	18,000			
August 16, 1895	Muirkirk pig No. 4, low	Cupola	5241	
	Muirkirk pig No. 4, high	1,500		
	Katabdin pig	2,000		
	Waterville pig	4,000		
	Heads	3,500		
	10-inch shell	2,000		
Total	14,500			
September 5, 1895	Muirkirk pig No. 4, high	Air furnace	5245	
	Muirkirk pig No. 4, low	3,600		
	Katabdin pig	3,600		
	Soft pig	3,600		
	Remelted pig	3,600		
	Total	18,000		
September 5, 1895	Muirkirk pig No. 4, high	Cupola	5245	
	Muirkirk pig No. 4, low	1,500		
	Katabdin pig	1,500		
	Waterville pig	3,500		
	Heads	3,500		
	10-inch shell	2,000		
Total	13,500			
September 25, 1895	Muirkirk pig No. 4, high	Air furnace	5255	
	Muirkirk pig No. 4, low	4,000		
	Katabdin pig	1,000		
	Soft pig	4,500		
	Remelted pig	4,500		
	Total	18,000		
September 25, 1895	Muirkirk pig No. 4, high	Cupola	5255	
	Muirkirk pig No. 4, low	2,000		
	Waterville pig	3,000		
	Steel scrap	2,000		
	Heads	3,000		
	10-inch shell	2,000		
Scrap	1,000			
Total	15,000			
October 12, 1895	Muirkirk pig No. 4, high	Air furnace	5259	
	Muirkirk pig No. 4, low	4,500		
	Soft pig	4,500		
	Remelted pig	4,500		
	Total	18,000		
	October 12, 1895	Muirkirk pig No. 4, high	Cupola	5259
Muirkirk pig No. 4, low		1,500		
Waterville pig		4,000		
Heads		3,500		
10-inch shell		2,000		
Scrap		2,500		
Total	15,000			
November 21, 1895	Muirkirk pig No. 4, high	Air furnace	5266	
	Muirkirk pig No. 4, low	6,000		
	Soft pig	6,000		
	Remelted pig	6,000		
Total	24,000			

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.
November 21, 1895	<i>Pounds.</i>		
	Muirkirk pig	2,000	Cupola
	Watervliet pig	3,000	
	Heads	2,000	
	10-inch shell	2,000	
	Scrap	4,000	
Total	13,000	5266	
March 20, 1896	Muirkirk pig No. 4, high	6,000	Air furnace
	Salisbury pig No. 4, high	2,800	
	Salisbury pig No. 4, low	2,700	
	Soft pig	5,500	
	Remelted pig	5,500	
	Total	22,500		5339
March 20, 1896	Muirkirk pig No. 4, high	2,000	Cupola
	Salisbury pig No. 4, high	2,300	
	Salisbury pig No. 4, low	2,200	
	Heads	3,500	
	10-inch shell	3,000	
	Scrap	6,500	
Total	19,500	5344	
April 21, 1896	Muirkirk pig No. 4, high	6,000	Air furnace
	Salisbury pig No. 4, high	2,800	
	Salisbury pig No. 4, low	2,700	
	Soft pig	5,600	
	Remelted pig	5,000	
	Total	22,000		5344
April 21, 1896	Muirkirk pig No. 4, high	2,000	Cupola
	Salisbury pig No. 4, high	2,300	
	Salisbury pig No. 4, low	2,200	
	Heads	3,500	
	10-inch shell	3,000	
	Scrap	6,500	
Total	19,500	5351	
May 21, 1896	Muirkirk pig No. 4, high	6,000	Air furnace
	Salisbury pig No. 4, high	2,800	
	Salisbury pig No. 4, low	2,700	
	Soft pig	5,500	
	Remelted pig	5,000	
	Total	22,000		5351
May 21, 1896	Muirkirk pig No. 4, high	8,000	Cupola
	Salisbury pig No. 4, high	2,300	
	Salisbury pig No. 4, low	2,200	
	Heads	4,700	
	10-inch shell	3,500	
	Scrap	9,000	
Total	24,700	5366	
June 18, 1896	Muirkirk pig No. 4, high	6,000	Air furnace
	Salisbury pig No. 4, high	2,800	
	Salisbury pig No. 4, low	2,700	
	Soft pig	5,500	
	Remelted pig	5,000	
	Total	22,000		5366
June 18, 1896	Muirkirk pig No. 4, high	3,000	Cupola
	Salisbury pig No. 4, high	2,000	
	Salisbury pig No. 4, low	2,000	
	Heads	4,200	
	10-inch shot	2,000	
	Scrap	2,500	
Total	15,700	5366	

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.																
October 29, 1895	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Muirkirk pig No. 4, low</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Watervliet pig</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Heads</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Scrap</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">14,000</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	3,000	Muirkirk pig No. 4, low	3,000	Watervliet pig	2,000	Heads	3,000	Scrap	3,000	Total	14,000	Cupola.....	5268		
		<i>Pounds.</i>																	
	Muirkirk pig No. 4, high	3,000																	
	Muirkirk pig No. 4, low	3,000																	
	Watervliet pig	2,000																	
Heads	3,000																		
Scrap	3,000																		
Total	14,000																		
April 23, 1896	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Salisbury pig No. 4, high</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Salisbury pig No. 4, low</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Heads</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>10-inch shell</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Scrap</td> <td style="text-align: right;">4,000</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">17,500</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	2,000	Salisbury pig No. 4, high	3,000	Salisbury pig No. 4, low	3,000	Heads	3,000	10-inch shell	2,500	Scrap	4,000	Total	17,500	do	5345
		<i>Pounds.</i>																	
	Muirkirk pig No. 4, high	2,000																	
	Salisbury pig No. 4, high	3,000																	
	Salisbury pig No. 4, low	3,000																	
Heads	3,000																		
10-inch shell	2,500																		
Scrap	4,000																		
Total	17,500																		
December 20, 1895	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Muirkirk pig No. 4, low</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Watervliet pig</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>10-inch shell</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Scrap</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Heads</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">16,000</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	2,500	Muirkirk pig No. 4, low	2,500	Watervliet pig	2,000	10-inch shell	3,000	Scrap	3,000	Heads	3,000	Total	16,000	do	5291
		<i>Pounds.</i>																	
	Muirkirk pig No. 4, high	2,500																	
	Muirkirk pig No. 4, low	2,500																	
	Watervliet pig	2,000																	
10-inch shell	3,000																		
Scrap	3,000																		
Heads	3,000																		
Total	16,000																		
January 9, 1896	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Muirkirk pig No. 4, low</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Heads</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>10-inch shell</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Scrap</td> <td style="text-align: right;">3,500</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">14,500</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	2,500	Muirkirk pig No. 4, low	2,500	Heads	3,000	10-inch shell	3,000	Scrap	3,500	Total	14,500	do	5297		
		<i>Pounds.</i>																	
	Muirkirk pig No. 4, high	2,500																	
	Muirkirk pig No. 4, low	2,500																	
	Heads	3,000																	
10-inch shell	3,000																		
Scrap	3,500																		
Total	14,500																		
January 24, 1896	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Muirkirk pig No. 4, low</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Heads</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>10-inch shell</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Scrap</td> <td style="text-align: right;">4,000</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">15,000</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	2,500	Muirkirk pig No. 4, low	2,500	Heads	3,000	10-inch shell	3,000	Scrap	4,000	Total	15,000	do	5303		
		<i>Pounds.</i>																	
	Muirkirk pig No. 4, high	2,500																	
	Muirkirk pig No. 4, low	2,500																	
	Heads	3,000																	
10-inch shell	3,000																		
Scrap	4,000																		
Total	15,000																		
February 8, 1896	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Muirkirk pig No. 4, low</td> <td style="text-align: right;">2,500</td> </tr> <tr> <td>Heads</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>10-inch shell</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Scrap</td> <td style="text-align: right;">4,000</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">15,000</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	2,500	Muirkirk pig No. 4, low	2,500	Heads	3,000	10-inch shell	3,000	Scrap	4,000	Total	15,000	do	5318		
		<i>Pounds.</i>																	
	Muirkirk pig No. 4, high	2,500																	
	Muirkirk pig No. 4, low	2,500																	
	Heads	3,000																	
10-inch shell	3,000																		
Scrap	4,000																		
Total	15,000																		
January 17, 1896	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">4,500</td> </tr> <tr> <td>Muirkirk pig No. 4, low</td> <td style="text-align: right;">4,000</td> </tr> <tr> <td>Soft pig</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Remelted pig</td> <td style="text-align: right;">500</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">12,000</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	4,500	Muirkirk pig No. 4, low	4,000	Soft pig	3,000	Remelted pig	500	Total	12,000	Air furnace...	5300				
		<i>Pounds.</i>																	
	Muirkirk pig No. 4, high	4,500																	
	Muirkirk pig No. 4, low	4,000																	
	Soft pig	3,000																	
Remelted pig	500																		
Total	12,000																		
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Muirkirk pig No. 4, low</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Soft pig</td> <td style="text-align: right;">1,000</td> </tr> <tr> <td>Heads</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>10-inch shell</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Scrap</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">13,000</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	2,000	Muirkirk pig No. 4, low	2,000	Soft pig	1,000	Heads	3,000	10-inch shell	2,000	Scrap	3,000	Total	13,000	Cupola.....		
	<i>Pounds.</i>																		
Muirkirk pig No. 4, high	2,000																		
Muirkirk pig No. 4, low	2,000																		
Soft pig	1,000																		
Heads	3,000																		
10-inch shell	2,000																		
Scrap	3,000																		
Total	13,000																		
February 28, 1896	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;"></td> <td style="text-align: right; font-weight: normal;"><i>Pounds.</i></td> </tr> <tr> <td>Muirkirk pig No. 4, high</td> <td style="text-align: right;">4,500</td> </tr> <tr> <td>Salisbury pig No. 4, high</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Salisbury pig No. 4, low</td> <td style="text-align: right;">2,000</td> </tr> <tr> <td>Soft pig</td> <td style="text-align: right;">3,000</td> </tr> <tr> <td>Remelted pig</td> <td style="text-align: right;">500</td> </tr> <tr> <td style="text-align: right;">Total</td> <td style="text-align: right; border-top: 1px solid black;">12,000</td> </tr> </table>		<i>Pounds.</i>	Muirkirk pig No. 4, high	4,500	Salisbury pig No. 4, high	2,000	Salisbury pig No. 4, low	2,000	Soft pig	3,000	Remelted pig	500	Total	12,000	Air furnace...	5329		
		<i>Pounds.</i>																	
	Muirkirk pig No. 4, high	4,500																	
	Salisbury pig No. 4, high	2,000																	
	Salisbury pig No. 4, low	2,000																	
Soft pig	3,000																		
Remelted pig	500																		
Total	12,000																		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Furnace.	No. of tension test.
February 28, 1896	<i>Pounds.</i>		
	Muirkirk pig No. 4, high	2,000	Cupola.....
	Salisbury pig No. 4, high	2,000	
	Heads	2,000	
	10-inch shell	2,000	
	Scrap	5,000	
Total.....	16,000		
March 31, 1896	Muirkirk pig No. 4, high	5,000	Air furnace.....
	Salisbury pig No. 4, high	2,000	
	Salisbury pig No. 4, low	2,000	
	Soft pig	3,000	
	Remelted pig.....	500	
	Total.....	12,500	
March 31, 1896	Muirkirk pig No. 4, high	2,000	Cupola.....
	Salisbury pig No. 4, high	2,000	
	Salisbury pig No. 4, low	1,500	
	Heads	3,000	
	10-inch shell	2,000	
	Scrap	2,000	
Total.....	12,500		
January 15, 1896	Muirkirk pig No. 4, high	1,500	do
	Muirkirk pig No. 4, low	1,500	
	Soft pig	1,000	
	Heads	1,500	
	10-inch shell	1,500	
	Scrap	2,500	
Total.....	9,500		

Where two furnaces were used for one casting they were run together in the mold, and are represented by one tension test.

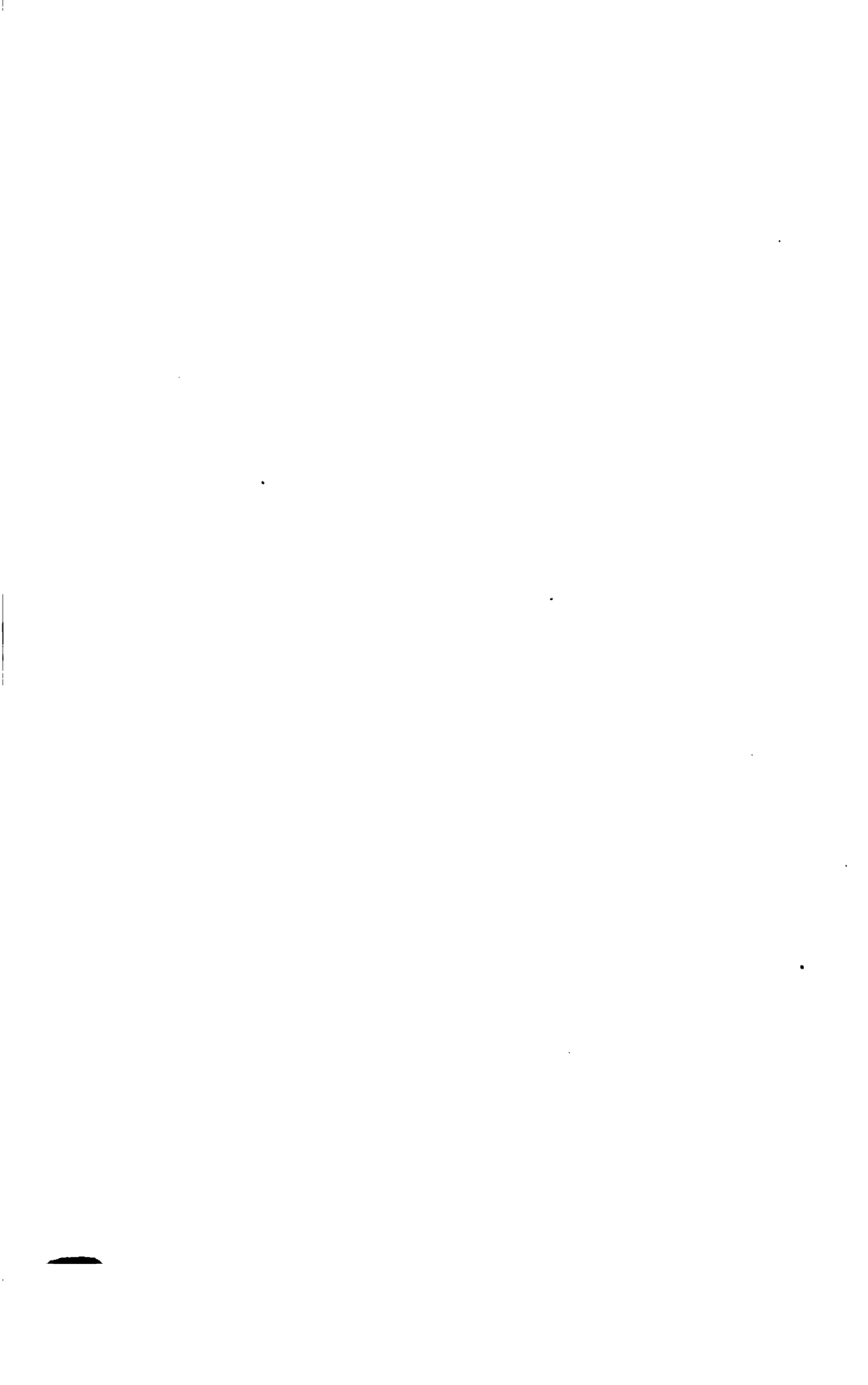
5340	8" shot, 12" shell	Mar. 27	29, 950	Granular, light gray, granite	7, 1609
5342	do	Apr. 7	28, 110	Granular, granite	7, 1886
5343	do	Apr. 14	31, 060	do	7, 1583
5345	12" shell, 8" shot	Apr. 23	30, 950	Granular, light gray	7, 1819
5346	12" shell, 10" shot	Apr. 30	31, 450	do	7, 1635
5349	do	May 7	31, 450	Granular, light gray	7, 1129
5350	do	May 14	29, 990	do	7, 2182
5358	do	June 2	32, 238	Fine granular, granite	7, 2066
5363	do	June 8	34, 080	Fine granular, light gray	7, 184
5363	do	1895			
5329	Bottom roller path for 12" mortar carriage	July 23	30, 510	Fine granular	7, 1716
5341	do	Aug. 16	36, 400	Fine granular, light gray, granite	7, 2763
5345	do	Sept. 5	38, 800	Fine granular, light gray	7, 2909
5245	do	Sept. 25	38, 020	do	7, 2633
5259	do	Oct. 12	38, 680	Fine granular, light gray, slightly mottled	7, 2583
5266	Top roller path, 12" mortar carriage	Nov. 21	36, 020	Fine granular	7, 2583
		1896			
5329	do	Mar. 20	35, 410	Granular, light gray	7, 2087
5344	do	Apr. 21	33, 900	Granular, gray	7, 1487
5351	do	May 21	34, 050	Granular, light gray, silvery luster	7, 1490
5366	do	June 18	36, 700	Fine granular, light gray	7, 185
5263	Side frame, 12" mortar carriage	Oct. 29	31, 990	Fine granular, dark gray	7, 2128
5254	Tramson, 14" mortar carriage	Nov. 5	27, 850	Fine granular	
5286	Side frame, 12" mortar carriage	Dec. 5	33, 210	do	
		1896			
5345	do	Apr. 23	30, 950	Granular, light gray	7, 1819
5346	do	Apr. 30	31, 450	do	
5348	do	May 7	26, 450	Granular, light and dark gray inter-spersed, spongy	7, 1423
5349	do	do	31, 850	Granular, light gray	
5353	do	June 8	34, 080	Fine granular, light gray	
5287	Bottom roller path, 10" disappearing carriage	Dec. 7	30, 050	Fine granular	
5291	do	Dec. 20	29, 020	Fine granular, dark gray	7, 1449
		1896			
5297	do	Jan. 9	29, 910	Fine granular, granite	7, 1672
5303	do	Jan. 24	31, 160	do	7, 1764
5318	do	Feb. 8	30, 900	do	7, 3188
		1896			
5293	Top 10" disappearing carriage	Dec. 27	37, 760	Fine granular, light gray	7, 2734
		1896			
5300	do	Jan. 17	38, 200	Fine granular, granite	7, 2755
5317	do	Feb. 6	37, 290	do	7, 2253
5329	do	Feb. 28	35, 290	Fine granular, light gray; irregular surface	7, 2290
5341	do	Mar. 31	36, 040	Granular, light gray	7, 2276

Cast iron from Watertown Arsenal Foundry—Continued.

No. of test.	Description.	Date of cast.	Chemical composition.						Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.	
			Carbon.		Man- ga- nese.	Sili- con.	Sul- phur.	Phos- phorus.					Cop- per.
			Total.	Gra- phitic.									
		1895.											
5259	Traverse circle, 10" disappearing carriage.	Jan. 15						32,450	Fine granular, granitic.	7.2376			
5302	do	Jan. 23						29,980	do	7.1612			
5308	do	Jan. 30						31,000	do	7.2923			
5316	do	Feb. 6						27,990	Granular, irregular surface	7.0946			
5320	do	Feb. 10						28,850	Fine granular, granitic	7.1451			
5333	do	Mar. 3						30,810	Fine granular, light gray, granitic	7.2479			
5334	do	Mar. 10						30,200	do	7.1494			
5336	do	Mar. 13						31,980	do	7.1894			
5340	do	Mar. 27						29,950	do	7.1609			
5350	do	do						29,990	Granular, light gray	7.2162			
5316	Stiffening bar, 10" disappearing carriage.	Feb. 6						27,990	Granular, irregular surface.	7.2162			
5336	Pintle plate.	Mar. 13						31,980	Granular, light gray, granitic	7.1894			

PIG IRONS.

5238	Richmond charcoal No. 4							18,900	Fine and medium fine granular metal interspersed.		
5239	Richmond charcoal No. 4, high							23,100	do	7.2588	
5246	Minkirk No. 4, high							31,250	Fine granular	7.2588	
5247	Minkirk No. 4, low							27,740	do	7.2794	
5251	do		3.059	2.200	0.859	0.706	1.569	0.112	0.419	0.000	
5252	do							27,990	do	7.3366	
5256	Rebecca No. 1, soft, American							13,320	Coarse and fine granular metal interspersed.	6.9909	
5268	Soft Clifton No. 1, coke.		4.205	2.893	1.312	0.200	2.045	0.915	0.476	0.010	
5285	Wata Kentucky		3.381	3.092	0.269	0.550	3.340	0.020	0.524	0.000	
5310	Salisbury No. 4, high							26,720	Very coarse granular; brilliant facets.		
5311	do							29,450	Fine granular; light gray	7.2045	
5312	do							30,590	Fine granular; coarser on one side; light gray	7.2531	
5313	do							29,020	Fine granular; light gray	7.2348	
5321	do							26,120	do	7.2165	



CHAIN CABLE AND CHAIN IRON

FROM

**BUREAU OF EQUIPMENT, UNITED STATES NAVY-
YARD, BOSTON, MASS.**

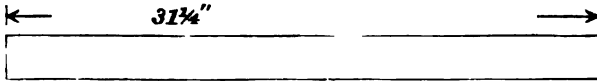
CHAIN CABLE.

[Samples consist of three studded links of chain each, with end links of larger diameter excepting Nos. 8364 and 8355, which contained two links of chain each.]

No. of test.	Brand on studs.	Marks.	Diameters.			Tensile strength.		Fracture.
			End links.	Links of chain.	Sec-tional area of chain.	Total.	Per square inch.	
			In.	In.	Sq. in.	Pounds.	Pounds.	
8191	U. S. N. Y. B		2.68	2.52	9.97	373,900	37,500	End link in the quarter. Fibrous.
8191a						440,500	44,180	Middle link of chain at the quarter weld; not across the opposite side. Both fractures were granular. The fracture at the quarter weld radiated from a point in the circumference about 80 degrees from a diametrical plane, cutting the two sides of the link, and toward the inside of the link. The fracture across the side of the link radiated from a point in the circumference at the inside of the link.
8192	do.		2.75	2.53	10.05	408,900	40,690	End link in the quarter. Fibrous.
8192a						439,200	43,700	Other end link in the quarter. Fibrous.
8192b						449,500	44,730	Middle link of chain in the quarter. Silky. The link also fractured at the opposite welded end, with a granular appearance radiating from the inside of the link. The latter fracture was a secondary one.
8348	Steel chain U. S. N. Y. B. 1895.		2.71	2.53	10.05	458,300	45,600	First link of the chain in the quarter. Silky. A secondary fracture occurred in the other quarter of the same end of the link, which presented a fine granular appearance radiating from a point at the inside of the link.
8349	U. S. N. Y. B.		2.71	2.42	9.20	324,800	35,300	First link of chain in the quarter. Fibrous.
8352	Iron		2.76	2.48	9.66	435,000	45,030	First link of chain, in the weld.
8353	Steel No. 1.		2.80	2.54	10.13	375,000	37,010	First link of chain in the quarter opposite the weld.
8354	Steel No. 2.		2.77	2.54	10.13	374,600	36,980	First link of chain in the weld.
8355	Steel No. 3.		2.77	2.54	10.13	400,200	39,510	First link of chain in the quarter opposite the weld. Silky.
8356	Steel No. 4.		2.75	2.55	10.21	371,600	36,400	Middle link of chain in the weld. Fine granular.
8360	U. S. N. Y. B. "Monongahela"		2.73	2.46	9.50	487,500	51,310	Middle link at welded end; also through opposite end. Link separated into three pieces. The fractures were all granular.
8365	U. S. 1895.		2.78	2.50	9.82	380,100	38,710	Middle link of chain in the quarter at the end opposite the weld. Fibrous.
8366	do.		2.78	2.51	9.90	387,600	38,150	Middle link of chain in the quarter at the end opposite the weld. Fibrous.

Sample No. 8360 had been strained with 380,000 pounds tension prior to the final test made at Watertown Arsenal.

CHAIN IRON.



No. of test.	Diameter.	Sectional area.	Tensile strength.		Area at fracture.	Contraction of area.
			Total.	Per square inch.		
	<i>Inches.</i>	<i>Sq. in.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches. Sq. in.</i>	<i>Per cent.</i>
8186	2.52	4.99	237,100	47,510	Diam. 1.40=2.84	43.1
8187	2.54	5.07	241,600	47,650	Diam. 1.87=2.75	45.8
8188	2.55	5.11	239,700	46,910	Diam. 1.86=2.72	46.8

Appearance of fractures, fibrous, laminated. At the center of each bar the metal was dull gray mingled with spots of lighter-colored metal.

CHAIN IRON.



No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
8363	•	Inches. 2.53	Sq in. 2.03	Pounds. 120,100	Pounds. 25,500	Pounds. 245,100	Pounds. 49,900	3.16	31.6	Inches. Diam. 1.98	Per ct. 44.7	Fibrous	" 28, 24, 24, 25, 27, 28, 27, 28, 28, 29, 28, 29*
8364	•	2.54	5.07	122,000	24,000	245,800	48,000	3.36	33.6	Diam. 1.97	39.5	.....do	" 30, 26, 27, 31, 27, 26, 27, 26, 26, 26, 26



BRONZE.



BRONZE FROM WATERTOWN ARSENAL FOUNDRY.

Composition	}	Cu..... per cent.. 57.5
		Zn..... do..... 42.
		Sn..... do..... .5

Specimens taken from coupons about $1\frac{1}{4}$ " by $1\frac{1}{8}$ ", cast with and attached to the dry-sand castings which they represent.

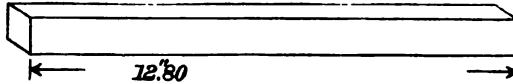
Description.	Diam-eter.	Sec-tional area.	Tensile strength per square inch.	Gauged length.		Con-traction of area.	Fracture.
				Inches.	Per ct.		
8" loading tray No. 1..	.564	.25	55,120	2	43	39.2	Light-yellow color; fractured surface contains blowhole ".02 diameter.
8" loading tray No. 2..	.564	.25	46,080	2	16.5	21.6	Light-lavender colored, interspersed with spots of yellow metal.
8" loading tray No. 3..	.564	.25	51,040	2	30.5	30.4	Light-yellow metal; fractured surface contains minute blow-holes.
8" loading tray No. 4..	.564	.25	52,160	2	47.5	42	Light-yellow metal; dark-brown spot ".03 diameter.
8" loading tray No. 5..	.564	.25	52,200	2	24	30.4	Uniform light-yellow metal.
8" loading tray No. 6..	.564	.25	49,560	2	50.5	47.2	Light-yellow metal; contains minute blow-holes.
8" loading tray No. 7..	.564	.25	52,040	2	35.5	30.4	Uniform light-yellow metal.
8" loading tray No. 8..	.564	.25	52,080	2	35.5	36.4	Do.
8" loading tray No. 9..	.564	.25	49,960	2	32.5	33.6	Light lavender colored with spots of yellow metal.
8" breech plate No. 1..	.564	.25	47,520	2	34	39.2	Uniform light golden yellow color.
8" breech plate No. 2..	.564	.25	44,080	2	26	27.6	Uniform light-yellow color.
8" breech plate No. 3..	.564	.25	47,960	2	28.5	33.6	Do.
8" breech plate No. 4..	.564	.25	50,240	2	34.5	30.4	Do.
8" breech plate No. 5..	.564	.25	50,040	2	38	33.6	Do.
8" breech plate No. 6..	.564	.25	50,080	2	32	33.6	Do.
8" breech plate No. 7..	.564	.25	52,960	2	37	33.6	Do.
8" breech plate No. 8..	.564	.25	50,240	2	29.5	36.4	Do.
8" breech plate No. 9..	.564	.25	52,040	2	29.5	30.4	Do.
8" loading tray No. 1..	.564	.25	50,100	2	25	34	Uniform yellow metal.
8" loading tray No. 2..	.564	.25	49,440	2	25.5	27.6	Do
8" loading tray No. 3..	.564	.25	50,880	2	36	36.4	Do
8" loading tray No. 4..	.564	.25	45,120	2	21	27.6	Lavender colored with spots of yellow metal.
8" loading tray No. 5..	.564	.25	49,246	2	34.5	33.6	Dark yellow with spots of metal ".01 diameter nearly black.
8" loading tray No. 6..	.564	.25	46,080	2	24.5	33.6	Lavender colored with yellow metal interspersed.
8" breech plate No. 1..	.564	.25	43,920	2	22.5	24.4	Silky irregular surface. Pale lavender and light shade of yellow intermingled.
8" breech plate No. 2..	.564	.25	48,240	2	26	37.6	Uniform light yellow.
8" breech plate No. 3..	.564	.25	47,926	2	23	21.6	Uniform golden yellow color.
8" breech plate No. 4..	.564	.25	51,960	2	26.5	24.4	Uniform light yellow.
8" breech plate No. 5..	.564	.25	50,440	2	38	39.2	Light yellow. Contains spots of dark-colored metal.
8" breech plate No. 6..	.564	.25	48,400	2	25.5	24.4	Uniform light yellow.
10" loading tray No. 1..	.564	.25	51,360	2	24.5	21.0	Light yellow.
10" loading tray No. 2..	.564	.25	54,280	2	35	30.4	Uniform light yellow.
10" loading tray No. 3..	.564	.25	55,920	2	34	36.4	Do
10" loading tray No. 4..	.564	.25	52,960	2	39	36.4	Do

Bronze from Watertown Arsenal Foundry—Continued.

Description.	Diam-eter.	Sec-tional area.	Tensile strength per square inch.	Gauged length.	Elongation in gauged length.	Con-traction of area.	Fracture.
	<i>Inch.</i>	<i>Sq. in.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Per ct.</i>	<i>Per ct.</i>	
10" loading tray No. 5.	.564	.25	51,920	2	26	24.4	Light yellow with lines of darker yellow.
10" loading tray No. 6.	.564	.25	55,040	2	35	36.4	Uniform light yellow.
10" loading tray No. 7.	.564	.25	57,880	2	29	27.6	Light yellow.
10" loading tray No. 8.	.564	.25	50,880	2	17	21.6	Light yellow 85 per cent, golden yellow spot near circumference 15 per cent.
10" loading tray No. 9.	.564	.25	57,160	2	28.5	27.6	Light yellow with gold-en-yellow spots.
10" loading tray No. 10.	.564	.25	50,760	2	26.5	27.6	Light yellow.
10" loading tray No. 11.	.564	.25	49,520	2	15.5	21.6	Light lavender, with golden-yellow metal interspersed.
12" loading tray No. 1.	.564	.25	57,160	2	26	30.4	Uniform light yellow.
12" loading tray No. 2.	.564	.25	52,960	2	15	21.6	Light yellow, with dark golden at circumfer-ence on one side of stem.
12" loading tray No. 3.	.564	.25	57,520	2	28.5	30.4	Uniform light yellow.
12" loading tray No. 4.	.564	.25	56,640	2	29	36.4	Do.
12" loading tray No. 5.	.564	.25	58,720	2	28.5	30.4	Do.
12" loading tray No. 6.	.564	.25	55,560	2	25	27.6	Do.
12" loading tray No. 7.	.564	.25	56,640	2	31	36.4	Do.
12" loading tray No. 8.	.564	.25	56,120	2	29	30.4	Do.
12" loading tray No. 9.	.564	.25	57,880	2	31	33.6	Do.
12" loading tray No. 10.	.564	.25	59,920	2	30.5	27.6	Do.
12" loading tray No. 11.	.564	.25	60,700	2	35.5	36.4	Do.
12" B. L. mortar tray..	.564	.25	50,880	2	22	27.6	Light-yellow metal con-taining minute dark spots, and darker yellow on one side.

BRONZE CAST BAR, REPRESENTING MATERIAL FOR STATUE OF GEN. W. S. HANCOCK, WASHINGTON D. C.

No. 8346.

Sectional area, $1'' .00 \times '' .99 = .99$ square inch.

Tensile strength, 31,100 pounds = 31,410 pounds per square inch.

Elongation in 4 inches, .77 = 19.2 per cent.

Elongation of inch sections: ".16, ".15, ".17, ".29*.

Appearance of fracture, dark-yellow color.

Vesicular surface. A cavity ".10 wide extends from corner to center of fractured surface. Opened cracks in surface of the bar during the progress of the test.

COPPER CYLINDERS FOR PRESSURE GAUGES.

COPPER CYLINDERS FOR PRESSURE GAUGES.

Mean compression of ten copper cylinders from lot of metal purchased at Frankford Arsenal in April, 1895.

Table for use with crusher gauge $\frac{1}{10}$ square inch area.

Mean dimensions of coppers: Length, ".4994; diameter, ".2511.

[Table prepared October 1, 1896.]

Load per square inch on crusher gauge $\frac{1}{10}$ square inch area.	Total compression.										Mean corrected sets.	
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.		Mean.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.		Inch.
2,000	.0038	.0045	.0019	.0040	.0086	.0021	.0043	.0036	.0044	.0055	.0088	.0086
6,000	.0141	.0141	.0122	.0152	.0188	.0118	.0155	.0189	.0128	.0180	.0137	.0132
8,000	.0182	.0177	.0160	.0170	.0185	.0158	.0191	.0175	.0160	.0181	.0174	.0168
10,000	.0211	.0213	.0189	.0208	.0216	.0189	.0225	.0203	.0197	.0220	.0208	.0202
12,000	.0249	.0258	.0240	.0258	.0266	.0231	.0267	.0239	.0238	.0258	.0247	.0240
13,000	.0283	.0280	.0278	.0288	.0289	.0266	.0310	.0290	.0270	.0298	.0285	.0277
14,000	.0318	.0321	.0319	.0329	.0340	.0310	.0350	.0326	.0316	.0347	.0328	.0319
15,000	.0364	.0370	.0360	.0408	.0420	.0382	.0440	.0410	.0395	.0430	.0414	.0408
16,000	.0402	.0410	.0403	.0420	.0428	.0427	.0484	.0456	.0441	.0475	.0458	.0447
17,000	.0445	.0454	.0457	.0481	.0515	.0493	.0529	.0501	.0490	.0521	.0504	.0493
18,000	.0490	.0504	.0495	.0511	.0537	.0525	.0578	.0545	.0539	.0577	.0551	.0540
19,000	.0538	.0545	.0541	.0564	.0582	.0611	.0679	.0625	.0676	.0653	.0631	.0627
20,000	.0593	.0602	.0593	.0622	.0641	.0659	.0728	.0662	.0645	.0690	.0668	.0657
21,000	.0623	.0648	.0630	.0655	.0680	.0705	.0770	.0705	.0684	.0720	.0691	.0680
22,000	.0664	.0689	.0687	.0700	.0735	.0721	.0776	.0731	.0723	.0765	.0744	.0723
23,000	.0738	.0789	.0780	.0785	.0801	.0806	.0820	.0779	.0770	.0817	.0791	.0779
24,000	.0785	.0791	.0772	.0801	.0806	.0820	.0851	.0836	.0820	.0865	.0844	.0832
25,000	.0827	.0844	.0835	.0850	.0857	.0866	.0896	.0884	.0872	.0921	.0895	.0883
26,000	.0884	.0887	.0879	.0885	.0918	.0896	.0930	.0918	.0896	.0922	.0904	.0892
27,000	.0931	.0950	.0920	.0935	.0972	.0919	.0978	.0946	.0922	.0962	.0944	.0932
28,000	.0980	.1009	.0963	.1005	.1021	.0970	.1034	.0984	.0970	.1027	.0996	.0986
29,000	.1046	.1050	.1044	.1064	.1074	.1018	.1095	.1039	.1018	.1065	.1033	.1041
30,000	.1089	.1106	.1074	.1118	.1120	.1049	.1150	.1096	.1081	.1124	.1108	.1090
31,000	.1130	.1159	.1119	.1175	.1171	.1124	.1190	.1142	.1126	.1180	.1152	.1139
32,000	.1194	.1210	.1178	.1220	.1232	.1178	.1246	.1195	.1181	.1240	.1207	.1194
33,000	.1259	.1290	.1290	.1278	.1294	.1297	.1297	.1293	.1225	.1299	.1258	.1245
34,000	.1295	.1314	.1279	.1324	.1343	.1290	.1350	.1300	.1279	.1337	.1310	.1297
35,000	.1346	.1370	.1330	.1389	.1394	.1324	.1404	.1354	.1331	.1389	.1363	.1349
36,000	.1394	.1421	.1390	.1432	.1455	.1382	.1453	.1405	.1385	.1447	.1416	.1402
37,000	.1451	.1474	.1426	.1487	.1514	.1440	.1504	.1470	.1440	.1506	.1471	.1457
38,000	.1500	.1532	.1474	.1540	.1568	.1487	.1580	.1510	.1498	.1566	.1530	.1506
39,000	.1553	.1589	.1534	.1599	.1609	.1540	.1615	.1526	.1506	.1615	.1574	.1560
40,000	.1605	.1620	.1596	.1644	.1673	.1574	.1670	.1612	.1585	.1660	.1623	.1609
41,000	.1654	.1681	.1622	.1699	.1717	.1635	.1714	.1670	.1634	.1713	.1673	.1659
42,000	.1696	.1733	.1678	.1751	.1769	.1694	.1770	.1720	.1685	.1765	.1725	.1711
43,000	.1748	.1786	.1732	.1799	.1824	.1738	.1818	.1761	.1740	.1816	.1775	.1761
44,000	.1805	.1832	.1769	.1852	.1867	.1785	.1863	.1815	.1780	.1870	.1834	.1810
45,000	.1860	.1890	.1825	.1889	.1925	.1831	.1910	.1860	.1834	.1911	.1872	.1858
46,000	.1915	.1925	.1890	.1936	.1970	.1878	.1959	.1913	.1876	.1960	.1919	.1905
47,000	.1967	.1970	.1911	.1987	.2015	.1922	.2012	.1965	.1923	.2009	.1960	.1955
48,000	.1993	.2040	.1953	.2042	.2060	.1970	.2060	.2015	.1970	.2055	.2016	.2002
49,000	.2045	.2074	.2000	.2085	.2108	.2019	.2101	.2055	.2018	.2092	.2050	.2046
50,000	.2092	.2120	.2054	.2118	.2150	.2059	.2154	.2100	.2056	.2135	.2104	.2090
51,000	.2134	.2190	.2089	.2166	.2195	.2102	.2188	.2140	.2095	.2183	.2145	.2131
52,000	.2170	.2200	.2130	.2205	.2238	.2145	.2230	.2183	.2140	.2222	.2186	.2172
53,000	.2220	.2231	.2160	.2249	.2274	.2159	.2267	.2226	.2181	.2260	.2226	.2212
54,000	.2252	.2276	.2191	.2284	.2319	.2220	.2310	.2256	.2224	.2308	.2263	.2249
55,000	.2290	.2316	.2238	.2322	.2352	.2264	.2349	.2294	.2256	.2340	.2295	.2288
56,000	.2330	.2345	.2276	.2364	.2395	.2300	.2380	.2334	.2291	.2376	.2337	.2323
57,000	.2359	.2385	.2314	.2402	.2425	.2337	.2420	.2366	.2321	.2407	.2367	.2352
58,000	.2400	.2413	.2349	.2432	.2461	.2365	.2452	.2408	.2365	.2446	.2409	.2396
59,000	.2435	.2446	.2385	.2461	.2484	.2401	.2486	.2436	.2400	.2480	.2443	.2430
60,000	.2462	.2481	.2416	.2498	.2525	.2441	.2521	.2474	.2435	.2511	.2476	.2462
61,000	.2490	.2511	.2447	.2522	.2553	.2468	.2550	.2504	.2465	.2541	.2505	.2493
62,000	.2522	.2543	.2479	.2558	.2588	.2497	.2581	.2534	.2497	.2575	.2537	.2524
63,000	.2552	.2574	.2509	.2582	.2618	.2531	.2608	.2564	.2526	.2605	.2567	.2554
64,000	.2583	.2618	.2540	.2616	.2650	.2556	.2640	.2593	.2552	.2635	.2598	.2585
65,000	.2616	.2632	.2569	.2645	.2671	.2589	.2663	.2626	.2581	.2660	.2625	.2612

Copper cylinders for pressure gauges—Continued.

Load per square inch on crusher gauge $\frac{1}{16}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
66,000	.2636	.2657	.2586	.2670	.2702	.2617	.2696	.2648	.2612	.2698	.2652	.2639
67,000	.2666	.2683	.2629	.2700	.2737	.2640	.2718	.2670	.2636	.2715	.2678	.2665
68,000	.2690	.2710	.2646	.2730	.2748	.2666	.2746	.2702	.2660	.2736	.2703	.2691
69,000	.2715	.2784	.2674	.2748	.2774	.2698	.2770	.2726	.2690	.2766	.2729	.2717
70,000	.2740	.2758	.2705	.2770	.2800	.2715	.2799	.2750	.2714	.2788	.2754	.2742
71,000	.2767	.2785	.2723	.2797	.2821	.2740	.2815	.2775	.2739	.2815	.2778	.2766
72,000	.2787	.2806	.2748	.2820	.2845	.2766	.2841	.2798	.2762	.2840	.2801	.2789
73,000	.2811	.2832	.2773	.2844	.2870	.2790	.2864	.2820	.2781	.2860	.2824	.2812
74,000	.2835	.2855	.2793	.2867	.2891	.2812	.2890	.2840	.2806	.2879	.2847	.2835
75,000	.2857	.2878	.2819	.2899	.2914	.2834	.2910	.2868	.2836	.2906	.2871	.2859
76,000	.2879	.2900	.2840	.2911	.2934	.2857	.2931	.2890	.2851	.2927	.2892	.2880
77,000	.2897	.2920	.2867	.2936	.2955	.2875	.2951	.2900	.2874	.2946	.2912	.2900
78,000	.2920	.2938	.2882	.2964	.2975	.2900	.2970	.2930	.2895	.2966	.2933	.2921
79,000	.2941	.2962	.2904	.2971	.2994	.2909	.2998	.2955	.2913	.2986	.2953	.2941
80,000	.2962	.2979	.2927	.2995	.3015	.2936	.3010	.2970	.2940	.3006	.2974	.2962
81,000	.2977	.2998	.2940	.3010	.3030	.2957	.3029	.2990	.2956	.3025	.2991	.2979
82,000	.2995	.3019	.2962	.3032	.3052	.2978	.3049	.3007	.2977	.3048	.3012	.3000
83,000	.3016	.3037	.2980	.3048	.3071	.2998	.3066	.3025	.2994	.3065	.3030	.3018
84,000	.3033	.3055	.3000	.3066	.3090	.3011	.3085	.3046	.3014	.3081	.3048	.3036
85,000	.3050	.3074	.3015	.3084	.3108	.3029	.3106	.3061	.3034	.3100	.3066	.3056
86,000	.3070	.3090	.3033	.3100	.3125	.3048	.3121	.3080	.3049	.3116	.3083	.3072
87,000	.3085	.3106	.3050	.3116	.3141	.3065	.3136	.3100	.3063	.3133	.3099	.3089
88,000	.3100	.3125	.3069	.3135	.3160	.3080	.3154	.3114	.3081	.3148	.3117	.3107
89,000	.3118	.3141	.3087	.3152	.3174	.3096	.3169	.3129	.3100	.3175	.3134	.3124
90,000	.3134	.3160	.3104	.3169	.3192	.3115	.3186	.3150	.3119	.3184	.3151	.3141
91,000	.3146	.3171	.3140	.3188	.3208	.3130	.3201	.3163	.3134	.3196	.3168	.3156
92,000	.3164	.3190	.3155	.3204	.3223	.3148	.3219	.3176	.3153	.3210	.3184	.3175
93,000	.3180	.3204	.3160	.3215	.3237	.3165	.3230	.3194	.3163	.3225	.3197	.3188
94,000	.3191	.3220	.3170	.3231	.3251	.3176	.3242	.3207	.3176	.3240	.3210	.3201
95,000	.3209	.3235	.3181	.3244	.3265	.3190	.3256	.3225	.3181	.3257	.3224	.3215
96,000	.3225	.3248	.3194	.3259	.3283	.3208	.3271	.3236	.3207	.3266	.3239	.3230
97,000	.3235	.3262	.3210	.3272	.3297	.3220	.3286	.3250	.3221	.3282	.3253	.3244
98,000	.3248	.3274	.3225	.3288	.3306	.3235	.3299	.3264	.3234	.3298	.3267	.3258
99,000	.3262	.3290	.3240	.3300	.3321	.3246	.3310	.3271	.3249	.3307	.3280	.3271
100,000	.3275	.3300	.3251	.3316	.3333	.3260	.3326	.3291	.3264	.3325	.3294	.3285

Mean compression of ten copper cylinders from lot of metal purchased at Frankford Arsenal in April, 1895.

Table for use with crusher gauge $\frac{1}{30}$ square inch area.
Mean dimensions of coppers: Length, ".4995; diameter, ".2054.

[Table prepared July 31, 1895.]

Load per square inch on crusher gauge $\frac{1}{30}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0002	.0003	.0003	.0002	.0004	.0003	.0004	.0002	.0004	.0003	.0003	.0003
9,000	.0006	.0006	.0007	.0003	.0006	.0006	.0009	.0004	.0008	.0006	.0006	.0006
10,000	.0007	.0009	.0009	.0005	.0008	.0007	.0013	.0007	.0011	.0009	.0008	.0007
11,000	.0008	.0013	.0012	.0007	.0009	.0009	.0018	.0008	.0016	.0010	.0011	.0010
12,000	.0010	.0021	.0015	.0020	.0012	.0014	.0025	.0010	.0023	.0014	.0016	.0015
13,000	.0015	.0039	.0023	.0035	.0020	.0028	.0040	.0022	.0034	.0030	.0029	.0028
14,000	.0031	.0054	.0036	.0059	.0035	.0044	.0055	.0033	.0049	.0044	.0044	.0042
15,000	.0045	.0072	.0051	.0070	.0052	.0064	.0071	.0056	.0064	.0063	.0061	.0059
16,000	.0060	.0090	.0074	.0093	.0068	.0081	.0090	.0074	.0088	.0080	.0079	.0076
17,000	.0076	.0104	.0091	.0107	.0085	.0097	.0109	.0093	.0102	.0097	.0096	.0092
18,000	.0095	.0128	.0110	.0122	.0104	.0119	.0130	.0114	.0120	.0115	.0116	.0112
19,000	.0112	.0143	.0128	.0145	.0124	.0135	.0148	.0125	.0139	.0132	.0133	.0129
20,000	.0133	.0164	.0149	.0160	.0146	.0152	.0165	.0150	.0163	.0155	.0154	.0149
21,000	.0153	.0182	.0166	.0183	.0160	.0178	.0184	.0168	.0176	.0170	.0172	.0167
22,000	.0171	.0200	.0183	.0202	.0179	.0193	.0204	.0182	.0200	.0190	.0190	.0185
23,000	.0189	.0230	.0202	.0226	.0200	.0212	.0225	.0206	.0215	.0216	.0211	.0205
24,000	.0209	.0244	.0225	.0249	.0216	.0238	.0244	.0228	.0237	.0235	.0232	.0226
25,000	.0230	.0260	.0239	.0264	.0243	.0256	.0265	.0246	.0258	.0248	.0251	.0244
26,000	.0250	.0281	.0263	.0283	.0256	.0274	.0289	.0266	.0273	.0275	.0271	.0264
27,000	.0269	.0306	.0284	.0314	.0281	.0300	.0307	.0284	.0300	.0297	.0294	.0286
28,000	.0288	.0325	.0308	.0328	.0298	.0318	.0333	.0306	.0321	.0310	.0313	.0305
29,000	.0318	.0347	.0329	.0349	.0320	.0343	.0354	.0328	.0335	.0345	.0336	.0327
30,000	.0334	.0370	.0355	.0377	.0345	.0366	.0380	.0349	.0355	.0367	.0359	.0350
31,000	.0355	.0390	.0370	.0394	.0374	.0390	.0394	.0370	.0380	.0381	.0379	.0369
32,000	.0384	.0434	.0399	.0418	.0389	.0402	.0416	.0394	.0403	.0402	.0403	.0392
33,000	.0402	.0439	.0420	.0440	.0415	.0435	.0439	.0419	.0421	.0424	.0425	.0415
34,000	.0423	.0464	.0444	.0465	.0439	.0447	.0461	.0444	.0440	.0446	.0448	.0437
35,000	.0450	.0480	.0461	.0484	.0453	.0479	.0489	.0469	.0472	.0466	.0470	.0459
36,000	.0472	.0510	.0485	.0506	.0476	.0494	.0510	.0485	.0495	.0499	.0493	.0482
37,000	.0487	.0528	.0507	.0521	.0497	.0519	.0532	.0502	.0516	.0517	.0514	.0503
38,000	.0513	.0551	.0525	.0550	.0525	.0546	.0555	.0533	.0547	.0541	.0538	.0527
39,000	.0537	.0574	.0556	.0569	.0539	.0562	.0579	.0555	.0574	.0565	.0561	.0550
40,000	.0556	.0596	.0566	.0597	.0564	.0583	.0599	.0578	.0583	.0585	.0581	.0570
41,000	.0586	.0626	.0598	.0619	.0589	.0613	.0634	.0599	.0610	.0611	.0607	.0596
42,000	.0605	.0646	.0621	.0654	.0615	.0630	.0651	.0630	.0641	.0637	.0633	.0622
43,000	.0628	.0670	.0650	.0670	.0638	.0655	.0671	.0652	.0657	.0655	.0655	.0644
44,000	.0646	.0697	.0667	.0690	.0659	.0676	.0693	.0667	.0682	.0674	.0675	.0664
45,000	.0678	.0714	.0689	.0725	.0681	.0702	.0719	.0688	.0710	.0710	.0702	.0691
46,000	.0698	.0740	.0720	.0739	.0700	.0723	.0743	.0720	.0729	.0729	.0726	.0717
47,000	.0725	.0762	.0735	.0770	.0740	.0754	.0766	.0749	.0756	.0753	.0751	.0739
48,000	.0751	.0791	.0759	.0790	.0753	.0775	.0791	.0763	.0773	.0781	.0773	.0761
49,000	.0785	.0816	.0795	.0817	.0781	.0798	.0816	.0783	.0800	.0804	.0799	.0787
50,000	.0799	.0828	.0816	.0835	.0800	.0818	.0839	.0815	.0821	.0822	.0822	.0810
51,000	.0823	.0859	.0836	.0862	.0828	.0848	.0868	.0841	.0856	.0854	.0847	.0835
52,000	.0837	.0886	.0864	.0885	.0850	.0869	.0885	.0867	.0880	.0875	.0869	.0857
53,000	.0861	.0920	.0890	.0913	.0871	.0890	.0910	.0890	.0900	.0893	.0893	.0881
54,000	.0886	.0941	.0910	.0936	.0892	.0913	.0933	.0918	.0920	.0919	.0911	.0899
55,000	.0920	.0971	.0938	.0961	.0920	.0945	.0965	.0932	.0946	.0938	.0942	.0930
56,000	.0940	.0988	.0969	.0982	.0950	.0968	.0983	.0951	.0970	.0968	.0968	.0956
57,000	.0963	.1017	.0983	.1011	.0973	.0995	.1006	.0980	.0999	.0992	.0992	.0981
58,000	.0981	.1034	.1004	.1037	.0996	.1019	.1033	.1005	.1028	.1024	.1016	.1004
59,000	.1018	.1070	.1036	.1063	.1015	.1041	.1058	.1030	.1055	.1050	.1045	.1033
60,000	.1040	.1090	.1069	.1096	.1041	.1071	.1088	.1060	.1074	.1073	.1070	.1057
61,000	.1059	.1108	.1080	.1107	.1070	.1088	.1108	.1083	.1100	.1094	.1090	.1077
62,000	.1085	.1130	.1105	.1130	.1095	.1120	.1136	.1107	.1125	.1125	.1116	.1103
63,000	.1109	.1160	.1130	.1168	.1121	.1145	.1159	.1141	.1145	.1142	.1142	.1129
64,000	.1130	.1189	.1159	.1195	.1147	.1164	.1180	.1169	.1170	.1172	.1167	.1154
65,000	.1159	.1211	.1181	.1213	.1163	.1191	.1210	.1188	.1194	.1198	.1191	.1178
66,000	.1181	.1240	.1206	.1238	.1186	.1215	.1230	.1210	.1224	.1220	.1215	.1202
67,000	.1203	.1272	.1230	.1260	.1220	.1242	.1253	.1235	.1250	.1240	.1240	.1227
68,000	.1225	.1289	.1257	.1281	.1240	.1265	.1280	.1260	.1266	.1265	.1268	.1250
69,000	.1261	.1311	.1261	.1311	.1261	.1292	.1305	.1290	.1295	.1290	.1290	.1276
70,000	.1283	.1340	.1308	.1336	.1284	.1320	.1328	.1311	.1321	.1315	.1315	.1301
71,000	.1302	.1368	.1330	.1364	.1306	.1334	.1355	.1336	.1343	.1341	.1337	.1323

Copper cylinders for pressure gauges—Continued.

Load per square inch on crusher gauge of square inch area.	Total compression.											Mean corrected sets.	
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.		
<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>	<i>Inch.</i>
72,000	.1329	.1385	.1385	.1384	.1386	.1365	.1379	.1355	.1365	.1374	.1363	.1349	
73,000	.1345	.1415	.1381	.1405	.1356	.1388	.1400	.1395	.1395	.1394	.1387	.1373	
74,000	.1365	.1440	.1403	.1433	.1385	.1406	.1427	.1415	.1411	.1410	.1409	.1395	
75,000	.1395	.1460	.1428	.1457	.1410	.1441	.1454	.1429	.1450	.1445	.1437	.1423	
76,000	.1420	.1481	.1456	.1480	.1430	.1454	.1475	.1452	.1468	.1465	.1458	.1444	
77,000	.1440	.1508	.1478	.1503	.1448	.1480	.1495	.1491	.1496	.1490	.1482	.1468	
78,000	.1465	.1532	.1500	.1530	.1483	.1514	.1525	.1510	.1510	.1517	.1509	.1495	
79,000	.1495	.1560	.1529	.1546	.1499	.1532	.1546	.1532	.1537	.1540	.1532	.1518	
80,000	.1511	.1581	.1545	.1570	.1515	.1552	.1568	.1548	.1565	.1557	.1551	.1537	
81,000	.1538	.1606	.1565	.1605	.1541	.1569	.1597	.1570	.1584	.1575	.1575	.1561	
82,000	.1554	.1623	.1586	.1629	.1564	.1598	.1626	.1590	.1609	.1605	.1598	.1584	
83,000	.1573	.1649	.1612	.1643	.1587	.1620	.1638	.1608	.1625	.1639	.1619	.1605	
84,000	.1602	.1671	.1635	.1665	.1606	.1647	.1660	.1631	.1651	.1654	.1642	.1628	
85,000	.1620	.1700	.1653	.1693	.1638	.1664	.1685	.1660	.1669	.1663	.1664	.1650	
86,000	.1643	.1775	.1685	.1707	.1650	.1695	.1702	.1679	.1696	.1685	.1692	.1678	
87,000	.1665	.1743	.1706	.1730	.1669	.1713	.1730	.1705	.1716	.1720	.1710	.1696	
88,000	.1687	.1768	.1730	.1758	.1690	.1734	.1749	.1727	.1738	.1733	.1731	.1717	
89,000	.1711	.1784	.1745	.1779	.1716	.1755	.1766	.1744	.1765	.1752	.1752	.1738	
90,000	.1729	.1806	.1772	.1805	.1735	.1775	.1795	.1769	.1795	.1789	.1777	.1763	
91,000	.1750	.1828	.1793	.1819	.1755	.1805	.1815	.1784	.1810	.1806	.1796	.1782	
92,000	.1764	.1855	.1813	.1840	.1771	.1820	.1832	.1804	.1824	.1819	.1814	.1800	
93,000	.1785	.1875	.1835	.1861	.1791	.1848	.1868	.1830	.1846	.1838	.1838	.1824	
94,000	.1810	.1891	.1860	.1883	.1814	.1862	.1885	.1850	.1862	.1864	.1858	.1844	
95,000	.1839	.1910	.1880	.1898	.1840	.1880	.1903	.1869	.1884	.1875	.1878	.1864	
96,000	.1852	.1929	.1894	.1919	.1857	.1904	.1920	.1891	.1904	.1898	.1897	.1883	
97,000	.1863	.1947	.1920	.1938	.1873	.1921	.1939	.1911	.1932	.1920	.1916	.1902	
98,000	.1880	.1968	.1936	.1965	.1891	.1942	.1953	.1922	.1949	.1935	.1935	.1921	
99,000	.1898	.1985	.1956	.1976	.1908	.1955	.1969	.1933	.1967	.1950	.1953	.1939	
100,000	.1920	.2008	.1974	.1993	.1931	.1980	.1990	.1972	.1988	.1983	.1974	.1960	

RIVETED JOINTS.



RIVETED JOINTS.

These joints were prepared and contributed for testing by Edward Kendall & Sons, Cambridgeport, Mass.

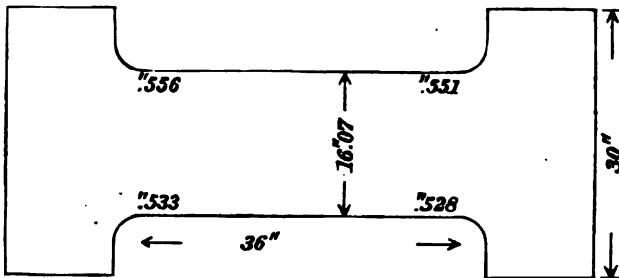
The tests were made under ordinary atmospheric conditions of temperature excepting joint No. 8508, which was tested hot, at the temperature of about 410° F.

The heating of this joint was done by means of gas-burners arranged below the specimen, which latter was protected by a sheet-iron muffle on the underside. The upper surface of the joint was covered with dry ashes to prevent rapid loss of heat by radiation.

The temperature was measured by means of a mercurial thermometer immersed in the oil pocket drilled in one of the rivets of an inside row.

STEEL PLATE REPRESENTING METAL USED IN RIVETED JOINTS
Nos. 9374, 9375, 9376, 9377, 9436, AND 9437.

No. 9438.



Brand on plate, "Coatsville, Pa., Fire box 55,000."

Sectional area, 8.75 square inches.

Gauged length, 30".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inches.	Inch.	
8,750	1,000	0.	0.	Initial load.
43,750	5,000	.0059	.0010	
87,500	10,000	.0114	.0010	
131,250	15,000	.0169	.0010	
175,000	20,000	.0223	.0010	
218,750	25,000	.0278	.0016	
227,500	26,000	.0289		
238,250	27,000	.0301		
245,000	28,000	.0313		
253,750	29,000	.0327		
262,500	30,000	.0339	.0030	Elastic limit.
271,250	31,000	.0354		
280,000	32,000	.0373		
288,750	33,000	.0406		
297,500	34,000	.0474		Scale starts off plate.
306,250	35,000	.11		
315,000	36,000	.53		
323,750	37,000	.57		
332,500	38,000	.61		
341,250	39,000	.66		
350,000	40,000	.71		
358,750	41,000	.77		
367,500	42,000	.83		
376,250	43,000	.89		
385,000	44,000	.96		
393,750	45,000	1.04		
402,500	46,000	1.11		
411,250	47,000	1.20		
420,000	48,000	1.30		
428,750	49,000	1.40		
437,500	50,000	1.51		
446,250	51,000	1.64		
455,000	52,000	1.79		
463,750	53,000	1.95		
472,500	54,000	2.14		
481,250	55,000	2.36		
490,000	56,000	2.60		
498,750	57,000	3.92		
507,500	58,000	3.99		
522,200	59,680			Tensile strength.

Elongation in 30 inches, $4''.63 = 15.4$ per cent.

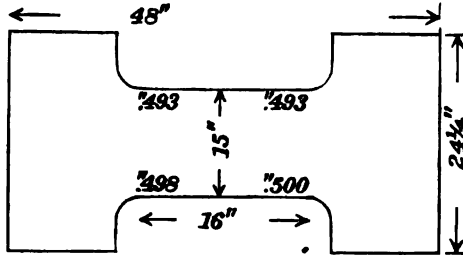
Elongation of 5-inch sections: ".68, ".78, ".81, ".78, ".79, ".79.

Minimum width of plate after the test, $15''.05$.

Plate tore apart, the fracture beginning at the neck and gradually extending across its width. Appearance silky, slightly lamellar.

STEEL PLATE REPRESENTING METAL USED IN RIVETED JOINTS
Nos. 8506 TO 8510, INCLUSIVE.

No. 8505.



Sectional area, 7.43 square inches.
Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inches.	Inch.	
7,490	1,000	0.	0.	Initial load.
37,150	5,000	.0021		
74,300	10,000	.0044	.0003	
111,450	15,000	.0066		
148,600	20,000	.0091		
185,750	25,000	.0116		
193,180	26,000	.0119		
200,610	27,000	.0127		
208,040	28,000	.0132		
215,470	29,000	.0136		
222,900	30,000	.0142	.0000	
280,330	31,000	.0146		
237,760	32,000	.0150		
245,190	33,000	.0155		
252,620	34,000	.0160			Elastic limit.
260,050	35,000	.0185	.0016	
267,480	36,000	.18		
274,910	37,000	.26		
282,340	38,000	.28		
289,770	39,000	.30		
297,200	40,000	.32		
304,630	41,000	.35		
312,060	42,000	.36		
319,490	43,000	.38		
326,920	44,000	.41		
334,350	45,000	.45		
341,780	46,000	.49		
349,210	47,000	.53		
356,640	48,000	.57		
364,070	49,000	.61		
371,500	50,000	.66		
378,930	51,000	.71		
386,360	52,000	.77		
393,790	53,000	.82		
401,220	54,000	.91		
408,650	55,000	1.01		
416,080	56,000	1.11		
423,510	57,000	1.26		
430,940	58,000	1.41		
438,370	59,000	1.62		
445,800	60,000	1.89		
449,900	60,550	2.25		Tensile strength.

Elongation in 15 inches, 2".43=16.2 per cent.

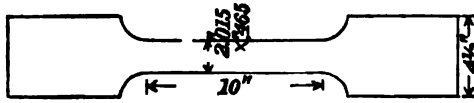
Elongation of inch sections: ".19, ".18, ".16, ".18, ".17, ".17, ".17, ".19, ".18, ".16, ".16, ".15, ".11, ".10.

Minimum width after fracture, 13".96.

Fractured at the neck. Appearance silky, lamellar.

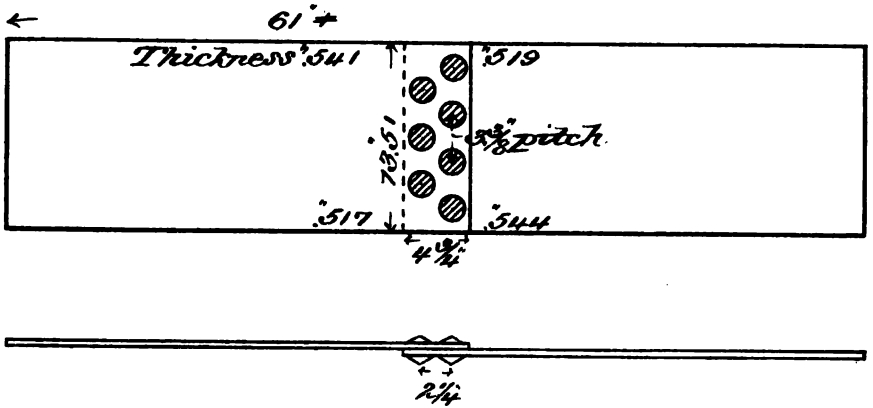
STEEL PLATE REPRESENTING METAL USED IN RIVETED JOINTS.
 NOS. 8515 AND 8516.

No. 8517.

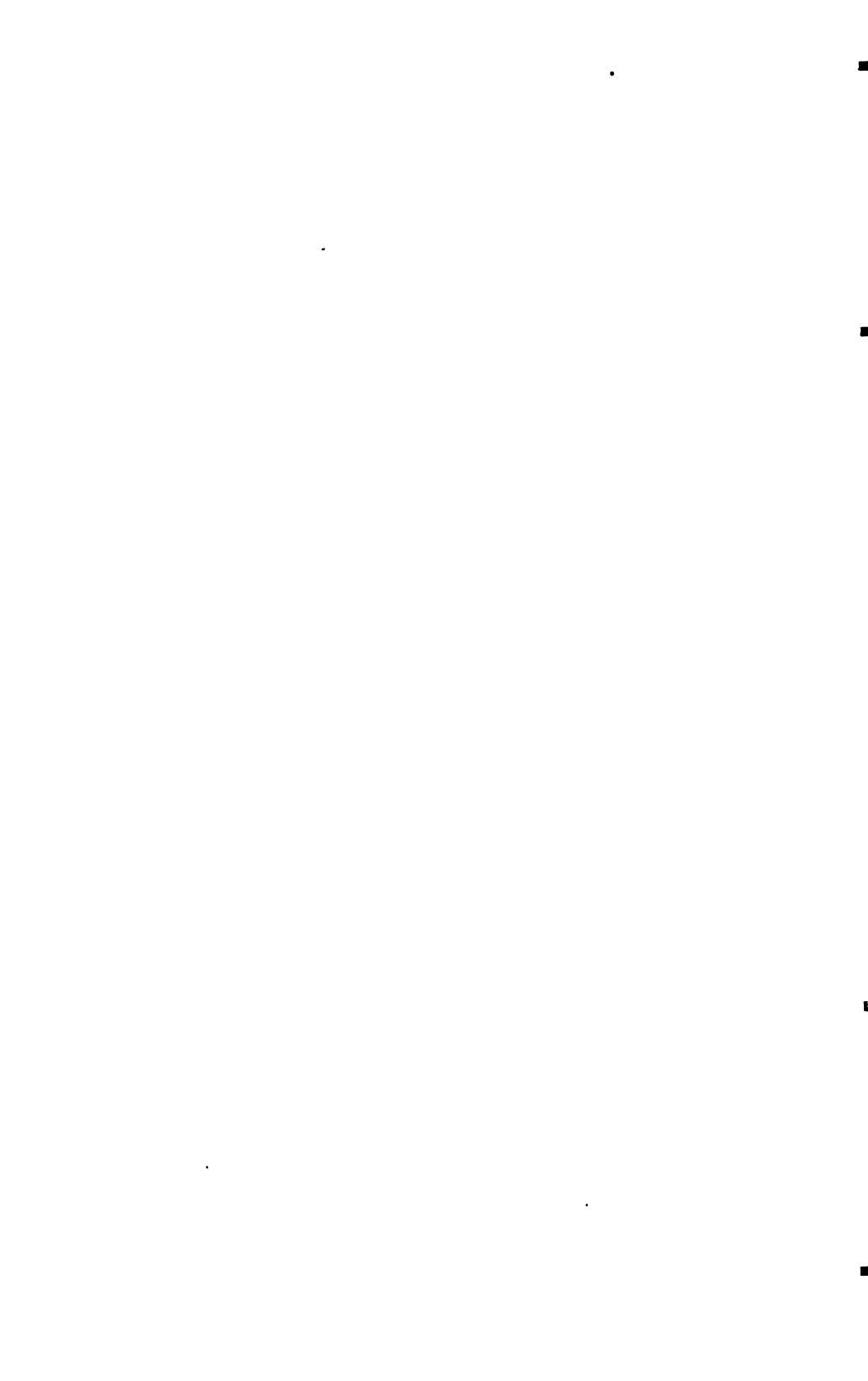


Sectional area, $2''.015 \times '' .465 = .937$ square inch.
 Elastic limit, 32,950 pounds = 35,160 pounds per square inch.
 Tensile strength, 56,120 pounds = 59,890 pounds per square inch.
 Elongation in 10 inches, $3''.06 = 30.6$ per cent.
 Elongation of inch sections: $'' .23, '' .27, '' .72^*, '' .39, '' .27, '' .25, '' .24,$
 $'' .24, '' .24, '' .21.$
 Area at fracture, $1''.47 \times '' .30 = .441$ square inch.
 Contraction of area, 52.9 per cent.
 Appearance of fracture, silky.

No. 9374



$\frac{7}{16}$ steel rivets
 $\frac{15}{16}$ drilled holes



No. 9374.

Gross sectional area of plate.....square inches.. 7.17
 Net sectional area of plate.....do..... 5.18
 Bearing surface of rivets.....do..... 3.48
 Shearing area of rivets.....do..... 4.83

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
7,170	1,000	0.	0.	Initial load.
14,340	2,000	.0009	.....
21,510	3,000	.0021	.....
28,680	4,000	.0032	.....
35,850	5,000	.0048	.0008	
43,020	6,000	.0065	.....
50,190	7,000	.0083	.....
57,360	8,000	.0104	.....
64,530	9,000	.0128	.....
71,700	10,000	.0161	.0055	
7,170	1,0000055	Scale starts off two rivet heads.
14,340	2,000	.0068	.....
21,510	3,000	.0074	.....
28,680	4,000	.0085	.....
35,850	5,000	.0098	.....
43,020	6,000	.0108	.....
50,190	7,000	.0121	.....
57,360	8,000	.0136	.....
64,530	9,000	.0150	.....
71,700	10,000	.0165	.....
78,870	11,000	.0191	Scale starts off plate in vicinity of rivets.
86,040	12,000	.0223	.....
93,210	13,000	.0260	.....
100,380	14,000	.0301	.....
107,550	15,000	.0361	.0175	
114,720	16,000	.0459	.....
121,890	17,000	.0584	.....
129,060	18,000	.07	.....
136,230	19,000	.09	.....
143,400	20,000	.11	.....
150,570	21,000	.12	Tensile strength.
157,740	22,000	.13	.....
164,910	23,000	.15	.....
172,080	24,000	.17	.....
179,250	25,000	.21	.....
186,420	26,000	.24	.....
193,590	27,000	.29	.....
200,760	28,000	.36	.....
201,700	28,130	.....	.....

Sheared the rivets.

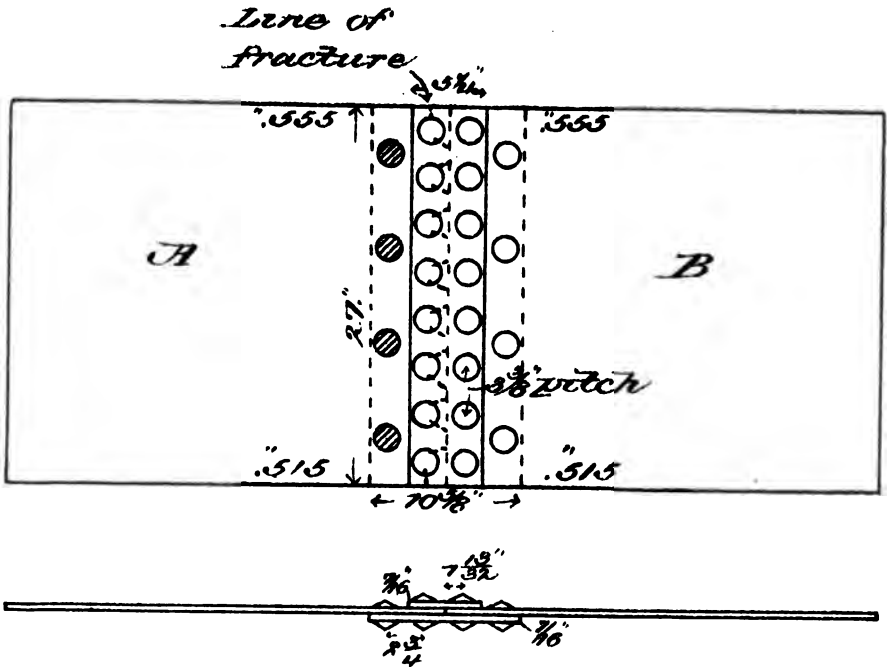
Elongation of rivet holes { Outside row ".05
 Inside row02

Maximum stress on joint.

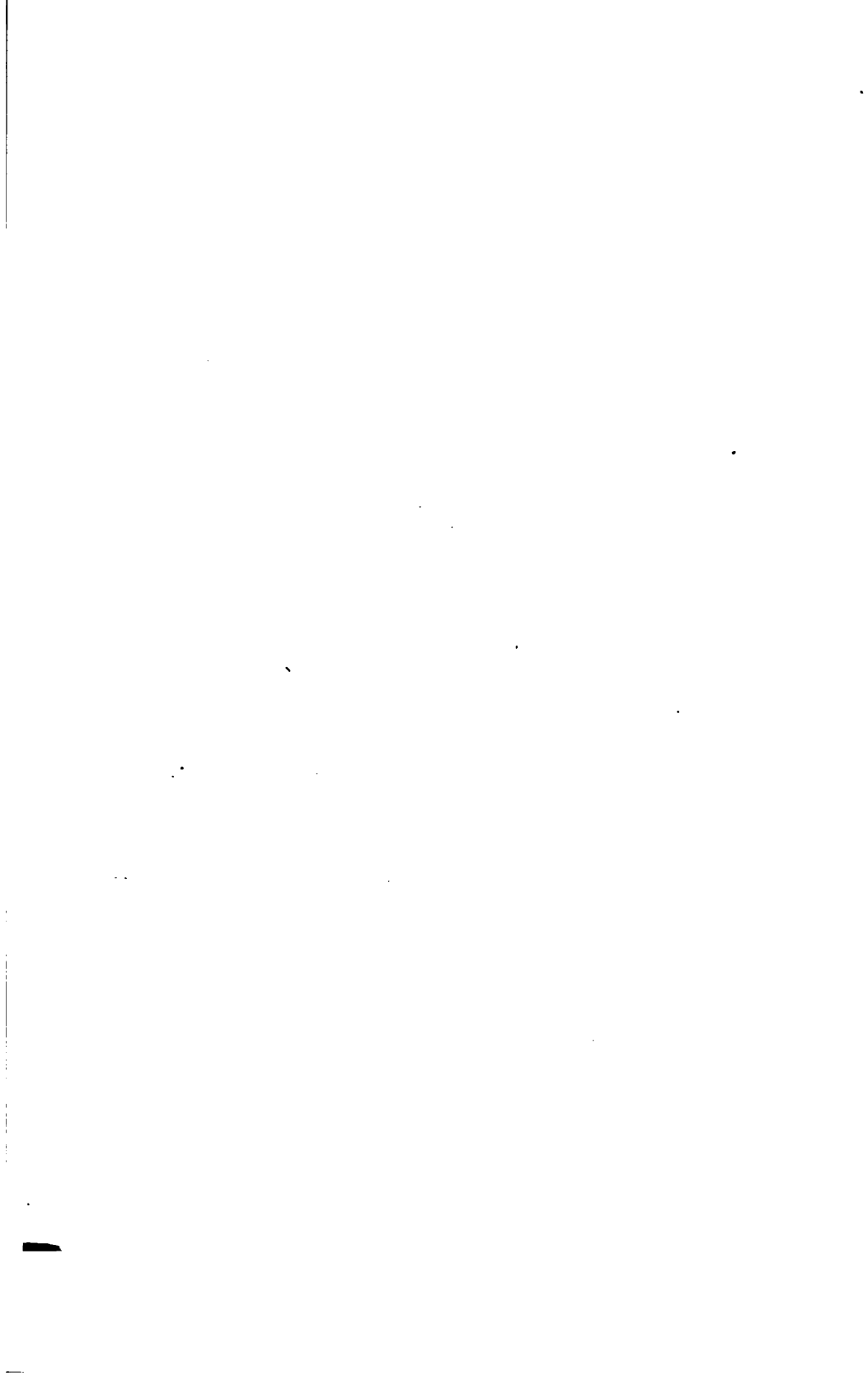
Tension on gross section of plate.....pounds per square inch.. 28.130
 Tension on net section of plate.....do..... 38.940
 Compression on bearing surface of rivets.....do..... 57.960
 Shearing on rivets.....do..... 41.760

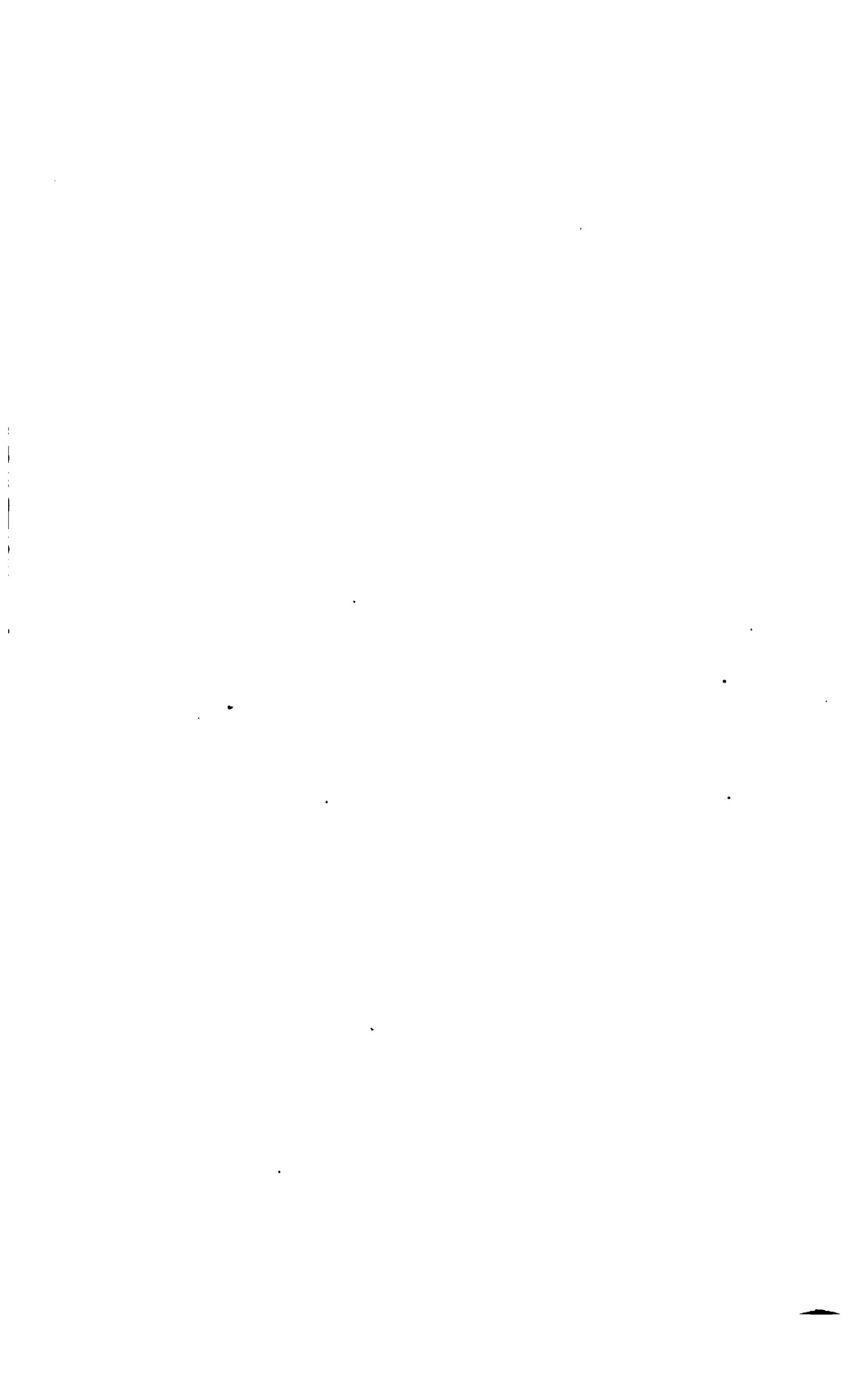
Efficiency of joint, 47.1 per cent.

No. 9377

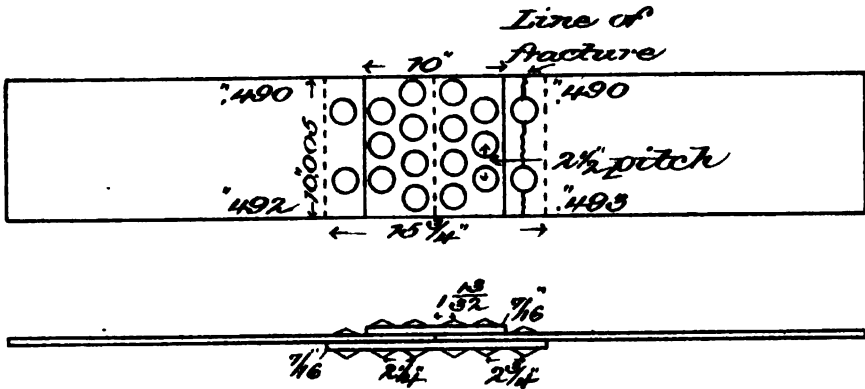


$\frac{7}{8}$ " steel rivets
 $\frac{1}{8}$ " drilled holes





No 8507



$\frac{7}{8}$ " steel rivets
 $\frac{1}{16}$ " drilled holes.

No. 8507.

Gross sectional area of plate.....	square inches..	4.91
Net sectional area of plate.....	do.....	3.99
Bearing surface of rivets.....	do.....	4.14
Shearing area of rivets.....	do.....	11.04

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
4,910	1,000	0.	0.	Initial load.
9,820	2,000	.0002	.....
14,730	3,000	.0005	.....
19,640	4,000	.0010	.....
24,550	5,000	.0016	0.	
29,460	6,000	.0021	.....
34,370	7,000	.0028	.....
39,280	8,000	.0037	.....
44,190	9,000	.0048	.....
49,100	10,000	.0060	.0018	
54,010	11,000	.0072	.....
58,920	12,000	.0089	.....
63,830	13,000	.0100	.....
68,740	14,000	.0116	.....
73,650	15,000	.0127	.0053	
78,560	16,000	.0141	.....
83,470	17,000	.0155	.....
88,380	18,000	.0165	.....
93,290	19,000	.0179	.....
98,200	20,000	.0190	.0072	
103,110	21,000	.0205	.....
108,020	22,000	.0218	.....
112,930	23,000	.0230	.....
117,840	24,000	.0245	.....
122,750	25,000	.0260	.0101	
127,660	26,000	.0280	.....
132,570	27,000	.0311	.....
137,480	28,000	.0322	.....
142,390	29,000	.0348	.....
147,300	30,000	.0375	.0168	
152,210	31,000	.0439	.....
157,120	32,000	.0485	.....
162,030	33,000	.06	.....
166,940	34,000	.07	.....
171,850	35,000	.09	.....
176,760	36,000	.14	.....
181,670	37,000	.20	.....
186,580	38,000	.23	.....
191,490	39,000	.26	.....
196,400	40,000	.29	.....
201,310	41,000	.32	.....
206,220	42,000	.36	.....
211,130	43,000	.40	.....
216,040	44,000	.44	.....
220,950	45,000	.49	.....
225,860	46,000	.53	.....
230,770	47,000	.60	.....
235,680	48,000	.66	.....
240,590	49,000	.74	.....
245,500	50,000	.84	.....
248,200	50,550	.92	.....

Scale starts off plate.

Tensile strength.

Scale did not start off rivet heads.
Fractured plate across first row of rivet holes.

Maximum stress on joint.

Tension on gross section of plate.....	pounds per square inch..	50,550
Tension on net section of plate.....	do.....	62,200
Compression on bearing surface of rivets.....	do.....	59,950
Shearing on rivets.....	do.....	22,480

Efficiency of joint, 83.5 per cent.

No. 8506.

Gross sectional area of plate	square inches..	6.73
Net sectional area of plate	do.....	5.80
Bearing surface of rivets	do.....	4.20
Shearing area of rivets	do.....	11.04

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inches.	Inch.	
6,730	1,000	0.	0.	Initial load.
12,460	2,000	.0005		
20,190	3,000	.0008		
28,920	4,000	.0014		
32,650	5,000	.0020	.0007	
40,380	6,000	.0027		
47,110	7,000	.0034		
58,840	8,000	.0043		
60,570	9,000	.0057		
67,300	10,000	.0070	.0035	
74,030	11,000	.0088		Scale starts off rivet heads.
80,760	12,000	.0098		
87,490	13,000	.0106		
94,220	14,000	.0122		
100,950	15,000	.0132	.0071	
107,680	16,000	.0154		
114,410	17,000	.0163		
121,140	18,000	.0181		
127,870	19,000	.0190		
134,600	20,000	.0204	.0099	
141,330	21,000	.0228		Scale starts off plate.
148,060	22,000	.0238		
154,790	23,000	.0252		
161,520	24,000	.0269		
168,250	25,000	.0281	.0142	
174,980	26,000	.0329		
181,710	27,000	.0350		
188,440	28,000	.0375		
195,170	29,000	.0413		
201,900	30,000	.0490	.0286	
208,630	31,000	.05		Tensile strength.
215,360	32,000	.07		
222,090	33,000	.10		
228,820	34,000	.15		
235,550	35,000	.20		
242,280	36,000	.25		
249,010	37,000	.30		
255,740	38,000	.35		
262,470	39,000	.38		
269,200	40,000	.42		
275,930	41,000	.45		
282,660	42,000	.52		
289,390	43,000	.59		
296,120	44,000	.66		
302,850	45,000	.72		
309,580	46,000	.84		
316,310	47,000	.84		
323,040	48,000	1.05		
327,200	48,620			

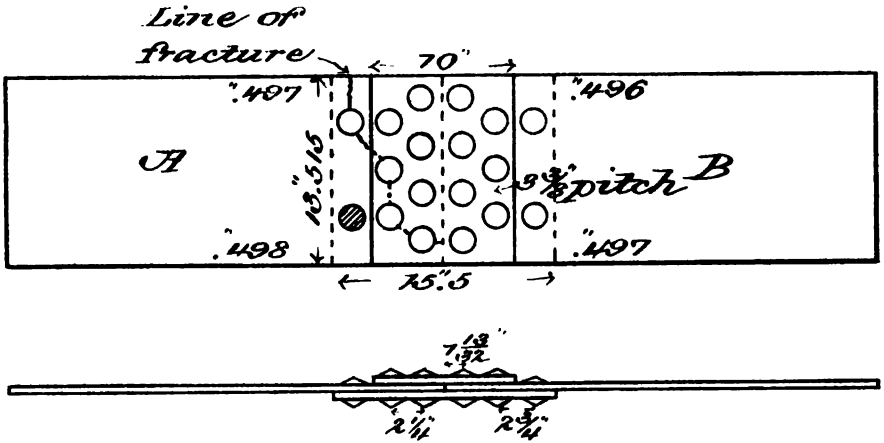
Sheared one rivet, and fractured plate across rivet holes in each row.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	48,620
Tension on net section of plate	do.....	56,410
Compression on bearing surface of rivets	do.....	77,900
Shearing on rivets	do.....	23,640

Efficiency of joint, 80.3 per cent.

No. 8506

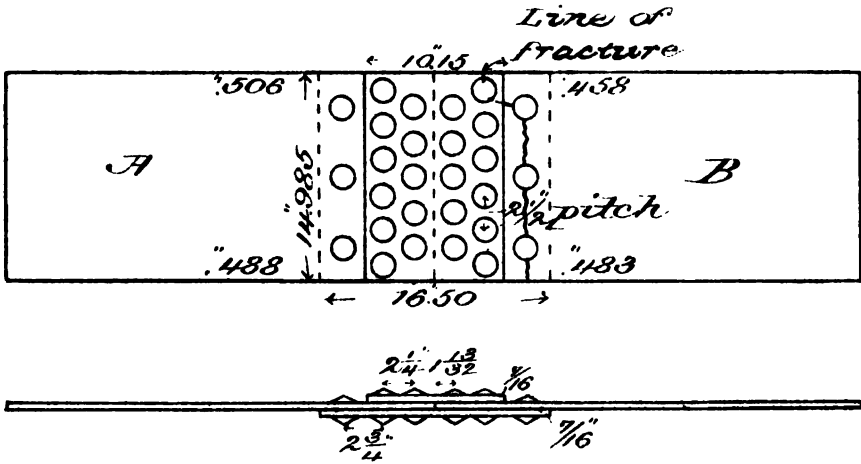


$\frac{7}{8}$ steel rivets
 $\frac{1}{16}$ drilled holes.





No. 8515



$\frac{1}{8}$ steel rivets
 $\frac{1}{16}$ drilled holes.

No. 8515.

Gross sectional area of plate.....square inches.. 7.05
 Net sectional area of plate.....do..... 5.73
 Bearing surface of rivets.....do..... 6.17
 Shearing area of rivets.....do..... 17.25

Gauged length, 20''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
7,050	1,000	0.	0.	Initial load.
14,100	2,000	.0008		
21,150	3,000	.0005		
28,200	4,000	.0009		
35,250	5,000	.0014	.0001	
42,300	6,000	.0020		
49,350	7,000	.0025		
56,400	8,000	.0031		
63,450	9,000	.0037		
70,500	10,000	.0043	.0012	
77,550	11,000	.0050		
84,600	12,000	.0056		
91,650	13,000	.0077		
98,700	14,000	.0090		
105,750	15,000	.0101	.0042	
112,800	16,000	.0114		
119,850	17,000	.0124		
126,900	18,000	.0139		
133,950	19,000	.0149		
141,000	20,000	.0163	.0071	
148,050	21,000	.0176		
155,100	22,000	.0190		
162,150	23,000	.0201		
169,200	24,000	.0216		
176,250	25,000	.0232	.0101	
183,300	26,000	.0254		
190,350	27,000	.0276		
197,400	28,000	.0300		
204,450	29,000	.0335		
211,500	30,000	.0407	.0218	Scale starts off plate.
218,550	31,000	.0445		
225,600	32,000	.0489		
232,650	33,000	.0610		
239,700	34,000	.0680	.0649	
246,750	35,000	.10		
253,800	36,000	.13		
260,850	37,000	.18		
267,900	38,000	.22		
274,950	39,000	.25		
282,000	40,000	.28		
289,050	41,000	.31		
296,100	42,000	.35		
303,150	43,000	.39		
310,200	44,000	.44		
317,250	45,000	.47		
324,300	46,000	.53		
331,350	47,000	.59		
338,400	48,000	.66		
345,450	49,000	.72		
352,500	50,000	.84		
359,550	51,000	.96		
361,000	51,205			Tensile strength.

Fractured plate B across outside row of rivet holes, extending to the end rivet of the second row.

Maximum stress on joint.

Tension on gross section of plate.....pounds per square inch.. 51,205
 Tension on net section of plate.....do..... 63,000
 Compression on bearing surface of rivets.....do..... 58,510
 Shearing on rivets.....do..... 20,930

Efficiency of joint, 85.5 per cent.

Gross sectional area of plate.....	square inches..	9.93
Net sectional area of plate.....	do.....	8.55
Bearing surface of rivets.....	do.....	6.43
Shearing area of rivets.....	do.....	17.25

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
0, 930	1, 000	0.	0.	
19, 860	2, 000	.0005	
29, 790	3, 000	.0010	.....
39, 720	4, 000	.0014	.....
49, 650	5, 000	.0019	.0009	
59, 580	6, 000	.0025	.....
69, 510	7, 000	.0030	.....
79, 440	8, 000	.0036	.....
89, 370	9, 000	.0044	.....
99, 300	10, 000	.0054	.0022	
109, 230	11, 000	.0064	.....
119, 160	12, 000	.0077	.....
129, 090	13, 000	.0093	.....
139, 020	14, 000	.0110	.....
148, 950	15, 000	.0125	.0056	
158, 880	16, 000	.0149	.....
168, 810	17, 000	.0163	.....
178, 740	18, 000	.0179	.....
188, 670	19, 000	.0195	.....
198, 600	20, 000	.0211	.0096	
208, 530	21, 000	.0226	.....
218, 460	22, 000	.0241	.....
228, 390	23, 000	.0260	.....
238, 320	24, 000	.0275	.....
248, 250	25, 000	.0299	.0140	
258, 180	26, 000	.0327	.....
268, 110	27, 000	.0354	.....
278, 040	28, 000	.0380	.....
287, 970	29, 000	.0406	.....
297, 900	30, 000	.0445	.0234	
307, 830	31, 000	.0540	.....
317, 760	32, 000	.0645	.....
327, 690	33, 000	.1050	.....
337, 620	34, 000	.1620	.1349	
347, 550	35, 000	.18	.....
357, 480	36, 000	.23	.....
367, 410	37, 000	.26	.....
377, 340	38, 000	.31	.....
387, 270	39, 000	.34	.....
397, 200	40, 000	.37	.....
407, 130	41, 000	.41	.....
417, 060	42, 000	.47	.....
426, 990	43, 000	.52	.....
436, 920	44, 000	.57	.....
446, 850	45, 000	.64	.....
456, 780	46, 000	.71	.....
466, 710	47, 000	.80	.....
476, 640	48, 000	.86	.....
486, 570	49, 000	.97	.....
496, 500	50, 000	1.07	.....
506, 430	51, 000	1.28	.....
507, 300	51, 088	Tensile strength.

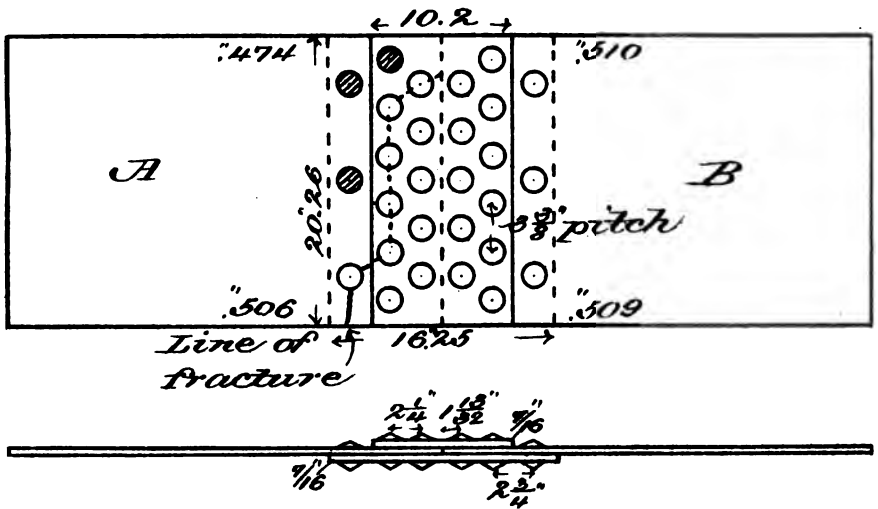
Sheared three rivets and tore plate across rivet holes in each row.

Maximum stress on joint.

Tension on gross section of plate.....	pounds per square inch..	51, 088
Tension on net section of plate.....	do.....	59, 330
Compression on bearing surface of rivets.....	do.....	78, 900
Shearing on rivets.....	do.....	29, 410

Efficiency of joint, 85.3 per cent.

No. 8516

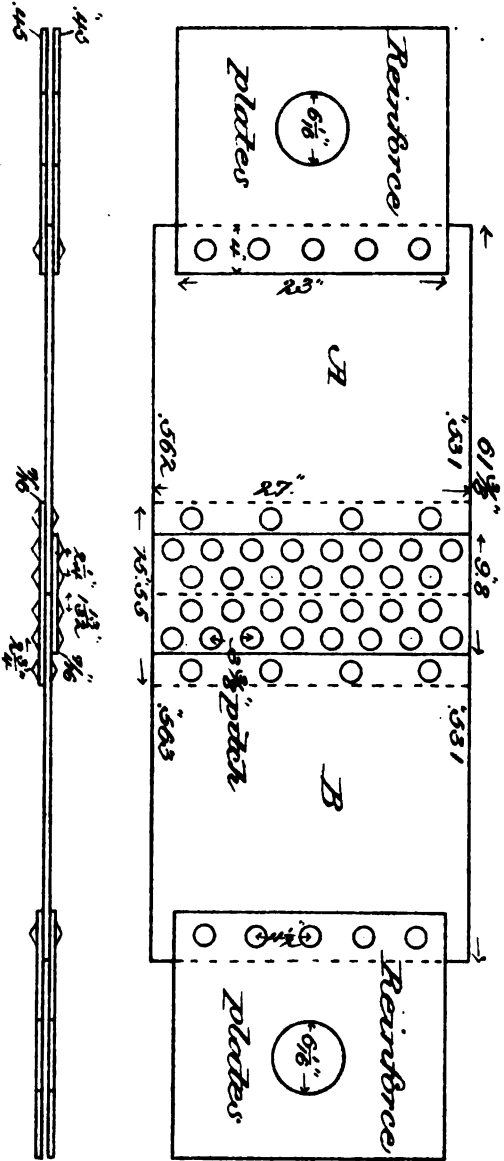


$\frac{7}{8}$ " steel rivets
 $\frac{5}{16}$ " drilled holes.





No. 9436.



3/8" steel rivets

1/8" drilled holes.

No. 9436.

Gross sectional area of plate.....	square inches..	14.77
Net sectional area of plate.....	do.....	12.72
Bearing surface of rivets.....	do.....	9.74
Shearing area of rivets.....	do.....	23.46

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
14,770	1,000	0.	0.	Initial load.
29,540	2,000	.0009		
44,310	3,000	.0018		
59,080	4,000	.0028		
73,850	5,000	.0038	.0002	
88,620	6,000	.0048		
103,390	7,000	.0053		
118,160	8,000	.0060		
132,930	9,000	.0074		
147,700	10,000	.0093	.0005	
162,470	11,000	.0112		
177,240	12,000	.0132		
192,010	13,000	.0152		
206,780	14,000	.0172		
221,550	15,000	.0187	.0043	
236,320	16,000	.0206		
251,090	17,000	.0219		
265,860	18,000	.0234		
280,630	19,000	.0250		
295,400	20,000	.0266	.0075		Snapping sounds. Snapping sounds repeated.
310,170	21,000	.0286		
324,940	22,000	.0303		
339,710	23,000	.0322		
354,480	24,000	.0341		
369,250	25,000	.0361	.0119	
384,020	26,000	.0385		
398,790	27,000	.0412		
413,560	28,000	.0439		
428,330	29,000	.0473		
443,100	30,000	.0524	.0241	Snapping sounds. Scale starts off rivet heads.
457,870	31,000	.06		
472,640	32,000	.07		
487,410	33,000	.10		
502,180	34,000	.16		
516,950	35,000	.21		
531,720	36,000	.25		
546,490	37,000	.27		
561,260	38,000	.30		
576,030	39,000	.35		
590,800	40,000	.38		
605,570	41,000	.41		
620,340	42,000	.46		
635,110	43,000	.51		
649,880	44,000	.56		
664,650	45,000	.62		
679,420	46,000	.70		
694,190	47,000	.78		
709,000	47,407			Maximum load reached.

Reinforce plates buckled, allowing joint to draw from the holder jaws.

Test discontinued; joint not fractured.

The plates were drawn down in width to 26".61, thus showing a contraction of ".39.

Maximum stress on joint.

Tension on gross section of plate.....	pounds per square inch..	47,407
Tension on net section of plate.....	do.....	55,050
Compression on bearing surface of rivets.....	do.....	71,890
Shearing on rivets.....	do.....	29,850

Efficiency of joint, 79.4 per cent.

No. 9376.

Gross sectional area of plate.....	square inches..	11.22
Net sectional area of plate.....	do.....	10.17
Bearing surface of rivets.....	do.....	6.82
Shearing area of rivets.....	do.....	14.49

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
11,220	1,000	0.	0.	Initial load.
22,440	2,000	.0011		
33,660	3,000	.0023		
44,880	4,000	.0036		
56,100	5,000	.0050	.0011	
67,320	6,000	.0064		
78,540	7,000	.0078		
89,760	8,000	.0094		
100,980	9,000	.0111		
112,200	10,000	.0130	.0051	
123,420	11,000	.0149		
134,640	12,000	.0167		
145,860	13,000	.0185		
157,080	14,000	.0202		
168,300	15,000	.0219	.0098		Scale starts off rivet heads.
179,520	16,000	.0236		
190,740	17,000	.0254		
201,960	18,000	.0273		
213,180	19,000	.0291		Scale generally started off the inside rows of rivet heads.
224,400	20,000	.0316	.0140	Scale starts off plate.
235,620	21,000	.0336		
246,840	22,000	.0355		
258,060	23,000	.0376		
269,280	24,000	.0404		
280,500	25,000	.0440	.0208	
291,720	26,000	.0485		
302,940	27,000	.0515		
314,160	28,000	.0558		
325,380	29,000	.0600		
336,600	30,000	.064		
347,820	31,000	.08		
359,040	32,000	.11		
370,260	33,000	.16		
381,480	34,000	.26		
392,700	35,000	.29		
403,920	36,000	.33		
415,140	37,000	.36		
426,360	38,000	.41		
437,580	39,000	.46		
448,800	40,000	.51		
460,020	41,000	.56		
471,240	42,000	.62		
482,460	43,000	.71		
493,680	44,000	.77		
504,900	45,000	.86		
516,120	46,000	.97		
522,100	46,530			Tensile strength.

Sheared 5 rivets in plate B and tore out plate in front of rivet holes at inside row.

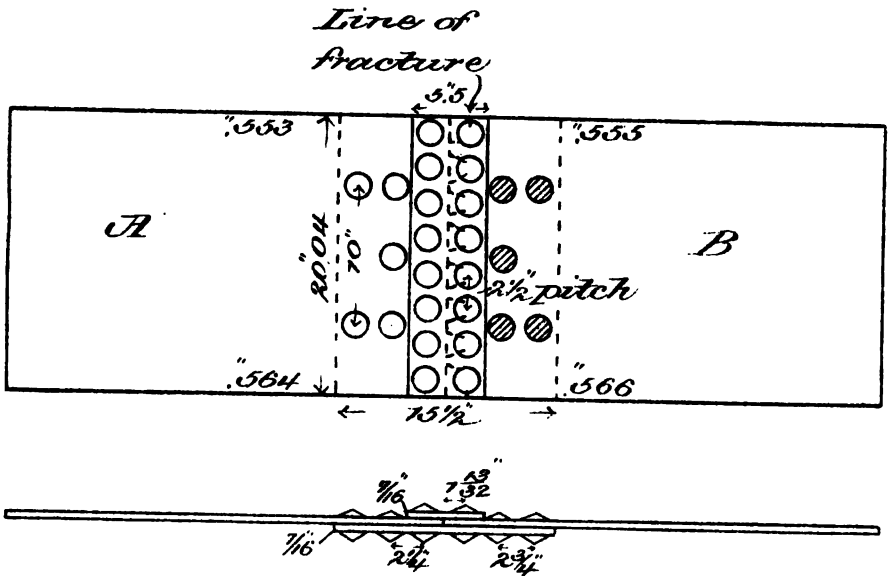
Elongation of rivet holes....	{ First row.....	". 19
	{ Second row, end holes.....	.15
	{ Second row, middle hole.....	.24

Maximum stress on joint.

Tension on gross section of plate.....	pounds per square inch..	46,530
Tension on net section of plate.....	do.....	51,340
Compression on bearing surface of rivets.....	do.....	76,550
Shearing on rivets.....	do.....	36,030

Efficiency of joint, 78.0 per cent.

No. 9376

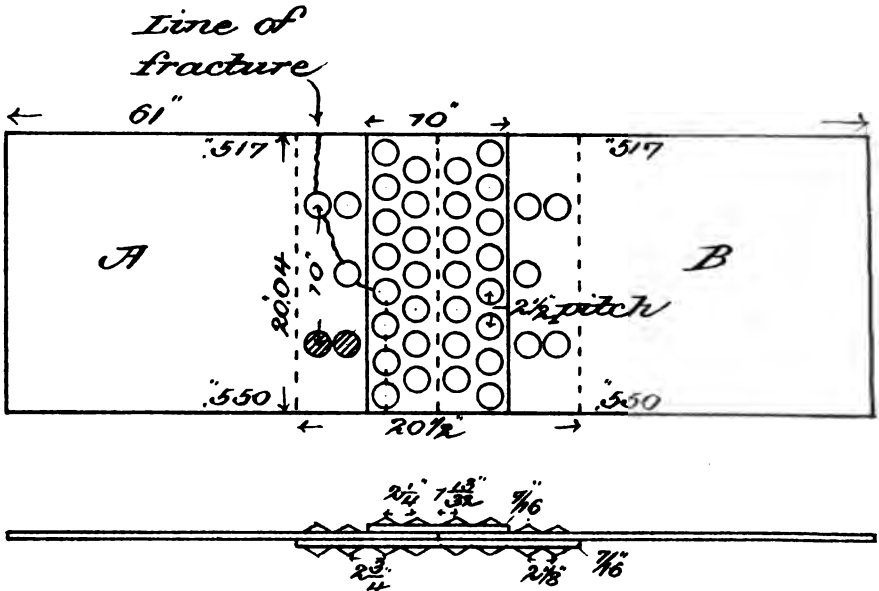


$\frac{7}{8}$ " steel rivets
 $1\frac{1}{16}$ " drilled holes





No. 9375



3/8 steel rivets
 7/16 drilled holes

No. 9375.

Gross sectional area of plate.....	square inches..	10.70
Net sectional area of plate.....	do.....	9.63
Bearing surface of rivets.....	do.....	10.01
Shearing area of rivets.....	do.....	24.15

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
10,700	1,000	0.	0.	
21,400	2,000	.0010	.....
32,100	3,000	.0018	.....
42,800	4,000	.0025	.....
53,500	5,000	.0034	.0008	
64,200	6,000	.0042	.....
74,900	7,000	.0052	.....
85,600	8,000	.0060	.....
96,300	9,000	.0072	.....
107,000	10,000	.0083	.0012	
117,700	11,000	.0091	.....
128,400	12,000	.0103	.....
139,100	13,000	.0116	.....
149,800	14,000	.0127	.....
160,500	15,000	.0150	.0043	
171,200	16,000	.0157	.....
181,900	17,000	.0213	.....
192,600	18,000	.0232	.....
203,300	19,000	.0260	.....
214,000	20,000	.0284	.....
224,700	21,000	.0304	.....
235,400	22,000	.0329	.....
246,100	23,000	.0343	.....
256,800	24,000	.0368	.....
267,500	25,000	.0390	.0136	
278,200	26,000	.0418	.....
288,900	27,000	.0430	.....
299,600	28,000	.0465	.....
310,300	29,000	.0494	.....
321,000	30,000	.0524	.0205	
331,700	31,000	.0578	.....
342,400	32,000	.06	.....
353,100	33,000	.07	.....
363,800	34,000	.10	.....
374,500	35,000	.13	.....
385,200	36,000	.16	.....
395,900	37,000	.18	.....
406,600	38,000	.20	.....
417,300	39,000	.23	.....
428,000	40,000	.26	.....
438,700	41,000	.29	.....
449,400	42,000	.31	.....
460,100	43,000	.36	.....
470,800	44,000	.40	.....
481,500	45,000	.44	.....
492,200	46,000	.50	.....
502,900	46,930	.....	.....

Scale starts off rivets first and second rows, plate A.

Scale starts off plates.

Tensile strength.

Fractured plate A through one rivet hole in first row, one in the second row, and four in the third row of rivet holes.

The fracture was visible at the edge of the plate opposite the third row of rivets, after which fractures were in sight at the sides of the rivet holes in the first and second rows. Finally these lines of fracture extended toward each other and completed the fracture of the plate. Appearance silky, slightly lamellar. Sheared 2 rivets.

Maximum stress on joint.

Tension on gross section of plate.....	pounds per square inch..	46,930
Tension on net section of plate.....	do.....	52,150
Compression on bearing surface of rivets.....	do.....	50,170
Shearing on rivets.....	do.....	20,790

Efficiency of joint, 78.6 per cent.

No. 8508.

Joint tested hot.

Gross sectional area of plate	square inches..	7.35
Net sectional area of plate.....	do.....	6.43
Bearing surface of rivets.....	do.....	7.34
Shearing area of rivets	do.....	18.63

Temperature of joint about 410° F.

Tensile strength, 401,200 pounds=54,580 pounds per square inch.

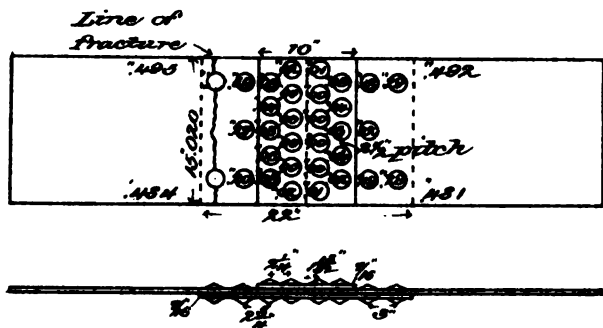
Fractured plate across first row of rivet holes.

Maximum stress on joint.

Tension on gross section of plate.....	pounds per square inch..	54,580
Tension on net section of plate.....	do.....	62,390
Compression on bearing surface of rivets.....	do.....	54,660
Shearing on rivets.....	do.....	21,530

Efficiency of joint, 90.1 per cent.

No. 8508



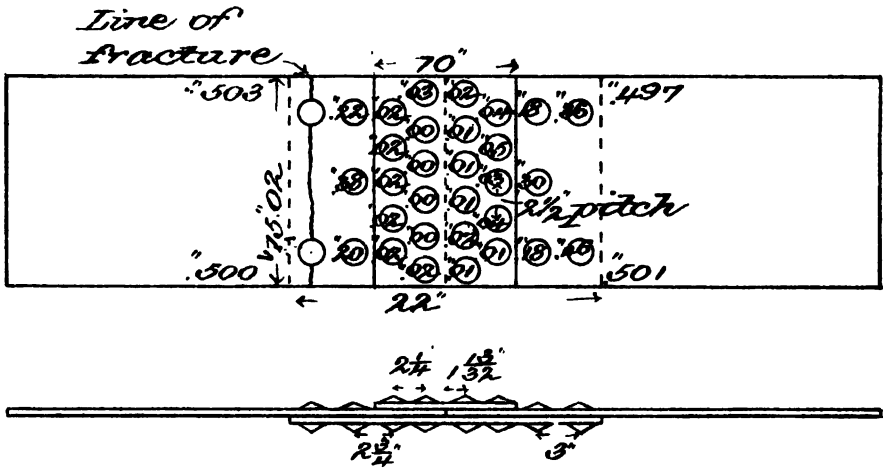
$\frac{1}{8}$ steel rivets
 $\frac{1}{16}$ drilled holes.

Elongation of rivet holes after fracture, shown by the figures on the rivet heads.





No. 8509



$\frac{7}{8}$ " steel rivets
 $\frac{1}{16}$ " drilled holes.

No. 8509.

Gross sectional area of plate.....	square inches..	7.49
Net sectional area of plate.....	do.....	6.56
Bearing surface of rivets.....	do.....	7.48
Shearing area of rivets.....	do.....	18.63

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
7,490	1,000	0.	0.	
14,980	2,000	.0004	.....
22,470	3,000	.0009	.....
29,960	4,000	.0019	.....
37,450	5,000	.0026	.0007	
44,940	6,000	.0034	.....
52,430	7,000	.0043	.....
59,920	8,000	.0052	.....
67,410	9,000	.0063	.....
74,900	10,000	.0074	.0029	
82,390	11,000	.0088	.....
89,880	12,000	.0099	.....
97,370	13,000	.0114	.....
104,860	14,000	.0128	.....
112,350	15,000	.0145	.0068	
119,840	16,000	.0158	.....
127,330	17,000	.0170	.....
134,820	18,000	.0182	.....
142,310	19,000	.0196	.....
149,800	20,000	.0209	.0095	
157,290	21,000	.0224	.....
164,780	22,000	.0236	.....
172,270	23,000	.0252	.....
179,760	24,000	.0264	.....
187,250	25,000	.0279	.0125	
194,740	26,000	.0302	.....
202,230	27,000	.0322	.....
209,720	28,000	.0346	.....
217,210	29,000	.0372	.....
224,700	30,000	.0395	.0191	
232,190	31,000	.0435	.....
239,680	32,000	.0490	.....
247,170	33,000	.07	.....
254,660	34,000	.08	.....
262,150	35,000	.09	.....
269,640	36,000	.11	.....
277,130	37,000	.13	.....
284,620	38,000	.16	.....
292,110	39,000	.17	.....
299,600	40,000	.19	.....
307,090	41,000	.22	.....
314,580	42,000	.25	.....
322,070	43,000	.26	.....
329,560	44,000	.30	.....
327,050	45,000	.34	.....
344,540	46,000	.37	.....
352,030	47,000	.41	.....
359,520	48,000	.46	.....
367,010	49,000	.51	.....
374,500	50,000	.56	.....
381,990	51,000	.64	.....
384,100	51,242	.....	.....	Tensile strength.

Fractured plate across first row of rivet holes.

Maximum stress on joint.

Tension on gross section of plate.....	pounds per square inch..	51,282
Tension on net section of plate.....	do.....	58,550
Compression on bearing surface of rivets.....	do.....	51,350
Shearing on rivets.....	do.....	20,620

Efficiency of joint, 84.7 per cent.

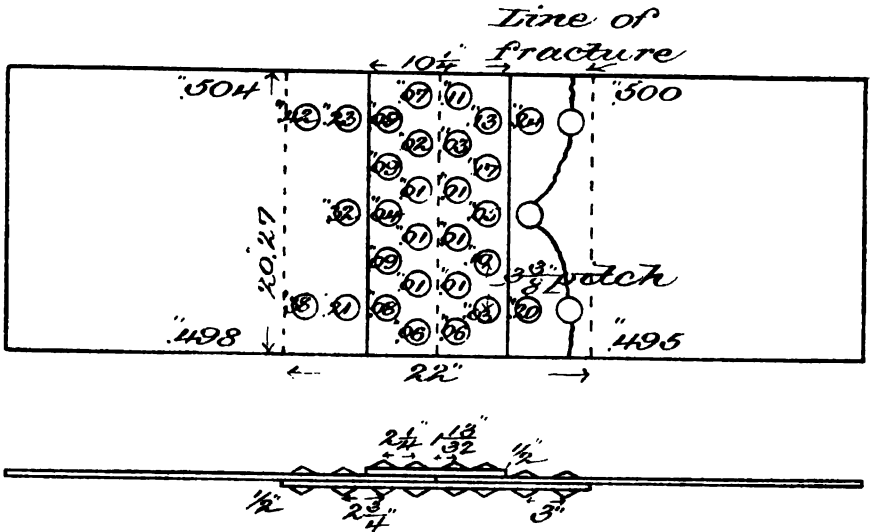
No. 8510.

Gross sectional area of platesquare inches.. 10.78
 Net sectional area of platedo..... 9.15
 Bearing surface of rivets.....do..... 7.46
 Shearing area of rivets.....do..... 18.63

Gauged length, 20''.

Applied loads.		Tension loads.		Compression loads.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Compression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
0	0	0.	0.			
10,080	1,000	.0011				
20,160	2,000	.0021				
30,240	3,000	.0034				
40,320	4,000	.0048				
50,400	5,000	.0069	.0011			
0	0				— 0.0011	
10,080	1,000			0.0005		
20,160	2,000			.0017		
30,240	3,000			.0026		
40,320	4,000			.0038		
50,400	5,000			.0050	— .0004	
0	0		.0004			
10,080	1,000	.0018				
20,160	2,000	.0030				
30,240	3,000	.0048				
40,320	4,000	.0061				
50,400	5,000	.0078	.0016			
0	0				— .0016	
10,080	1,000			— .0001		
20,160	2,000			.0012		
30,240	3,000			.0024		
40,320	4,000			.0036		
50,400	5,000			.0049	— .0001	
0	0		.0001			
10,080	1,000	.0021				
20,160	2,000	.0034				
30,240	3,000	.0049				
40,320	4,000	.0064				
50,400	5,000	.0079	.0020			
0	0				— .0016	
10,080	1,000			— .0001		
20,160	2,000			.0011		
30,240	3,000			.0022		
40,320	4,000			.0035		
50,400	5,000			.0048	— .0001	
0	0		.0001			
10,080	1,000	.0019				
20,160	2,000	.0035				
30,240	3,000	.0049				
40,320	4,000	.0065				
50,400	5,000	.0079				
60,480	6,000	.0095				
70,560	7,000	.0109				
80,640	8,000	.0126				
90,720	9,000	.0144				
100,800	10,000	.0161	.0046			
0	0				— .0046	
10,080	1,000			— .0029		
20,160	2,000			— .0015		
30,240	3,000			.0000		
40,320	4,000			+ .0017		
50,400	5,000			.0034	— .0012	
0	0		.0012			
10,080	1,000	.0024				
20,160	2,000	.0035				
30,240	3,000	.0050				
40,320	4,000	.0061				
50,400	5,000	.0079	.0029			
60,480	6,000	.0105				
70,560	7,000	.0124				
80,640	8,000	.0138				
90,720	9,000	.0152				
100,800	10,000	.0164	.0046			
0	0				— .0046	

No. 8510



$\frac{7}{8}$ " steel rivets
 $\frac{15}{16}$ " drilled holes.

Applied loads.		Tension loads.		Compression loads.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Compression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
10,080	1,000			— .0030		
20,160	2,000			— .0016		
30,240	3,000			+ .0001		
40,320	4,000			.0017		
50,400	5,000			.0034	— .0013	
	0		.0013			
10,080	1,000	.0026				
20,160	2,000	.0037				
30,240	3,000	.0051				
40,320	4,000	.0065				
50,400	5,000	.0084				
60,480	6,000	.0108				
70,560	7,000	.0128				
80,640	8,000	.0141				
90,720	9,000	.0154				
100,800	10,000	.0165				
110,880	11,000	.0181				
120,960	12,000	.0194				
131,040	13,000	.0207				
141,120	14,000	.0221				
151,200	15,000	.0235				
161,280	16,000	.0250				
171,360	17,000	.0264				
181,440	18,000	.0279				
191,520	19,000	.0291				
201,600	20,000	.0307	.0101			
	0				— .0101	
10,080	1,000			— .0083		
20,160	2,000			— .0068		
30,240	3,000			— .0051		
40,320	4,000			— .0028		
50,400	5,000			— .0002	— .0049	
	0		.0049			
30,240	3,000	.0084				
40,320	4,000	.0088				
50,400	5,000	.0112	.0071			
100,800	10,000	.0197				
201,600	20,000	.0312				
211,680	21,000	.0336				
221,760	22,000	.0352				
231,840	23,000	.0373				
241,920	24,000	.0390				
252,000	25,000	.0412				
262,080	26,000	.0432				
272,160	27,000	.0452				
282,240	28,000	.0471				
292,320	29,000	.0495				
302,400	30,000	.0514				Scale starts off plate.
312,480	31,000	.0538				
322,560	32,000	.06				
332,640	33,000	.07				
342,720	34,000	.10				
362,880	36,000	.16				
383,040	38,000	.22				
403,200	40,000	.28				
423,360	42,000	.35				
443,520	44,000	.42				
463,680	46,000	.53				
483,840	48,000					
503,500	49,960					Tensile strength.

Fractured plate B across rivet holes in first and second row. Appearance, silky.

Maximum stress on joint.

Tension on gross section of plate..... pounds per square inch.. 49,960
 Tension on net section of plate do..... 55,030
 Compression on bearing surface of rivets..... do..... 67,490
 Shearing on rivets..... do..... 27,030

Efficiency of joint, 82.5 per cent.

No. 9437.

Gross sectional area of plate.....	square inches..	15.08
Net sectional area of plate.....	do.....	13.88
Bearing surface of rivets.....	do.....	10.45
Shearing area of rivets.....	do.....	24.15

Gauged length, 20".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
15,080	1,000	0.	0.		
30,160	2,000	.0007	.....	
45,240	3,000	.0013	.....	
60,320	4,000	.0019	.....	
75,400	5,000	.0026	0.		
90,480	6,000	.0032	.....	
105,560	7,000	.0042	.....	
120,640	8,000	.0052	.....	
135,720	9,000	.0064	.....	
150,800	10,000	.0082	.0022		
165,880	11,000	.0097	.....	
180,960	12,000	.0113	.....	
196,040	13,000	.0129	.....	
211,120	14,000	.0140		Scale starts off rivet heads in middle row of rivets (row of 3).
226,200	15,000	.0165	.0068		
241,280	16,000	.0184	.....	
256,360	17,000	.0199	.....	
271,440	18,000	.0217	.....	
286,520	19,000	.0230	.....	
301,600	20,000	.0248	.0113		
316,680	21,000	.0267	.....	
331,760	22,000	.0278	.....	
346,840	23,000	.0299	.....	
361,920	24,000	.0317	Scale starts off plate.	
377,000	25,000	.0337	.0157		
392,080	26,000	.0363	.....	
407,160	27,000	.0386	.....	
422,240	28,000	.0408	.....	
437,320	29,000	.0441	.....	
452,400	30,000	.0479	.0255		
467,480	31,000	.0557	.....	
482,560	32,000	.07	.....	
497,640	33,000	.09	.....	
512,720	34,000	.12	.....	
527,800	35,000	.16	.....	
542,880	36,000	.19	.....	
557,960	37,000	.23	.....	
573,040	38,000	.26	.....	
588,120	39,000	.29	.....	
603,200	40,000	.33	.....	
618,280	41,000	.36	.....	
633,360	42,000	.41	.....	
640,000	42,440	Maximum load applied.	

Reenforce plates buckled, allowing joint to draw from the holder jaws. Test discontinued. Joint not fractured.

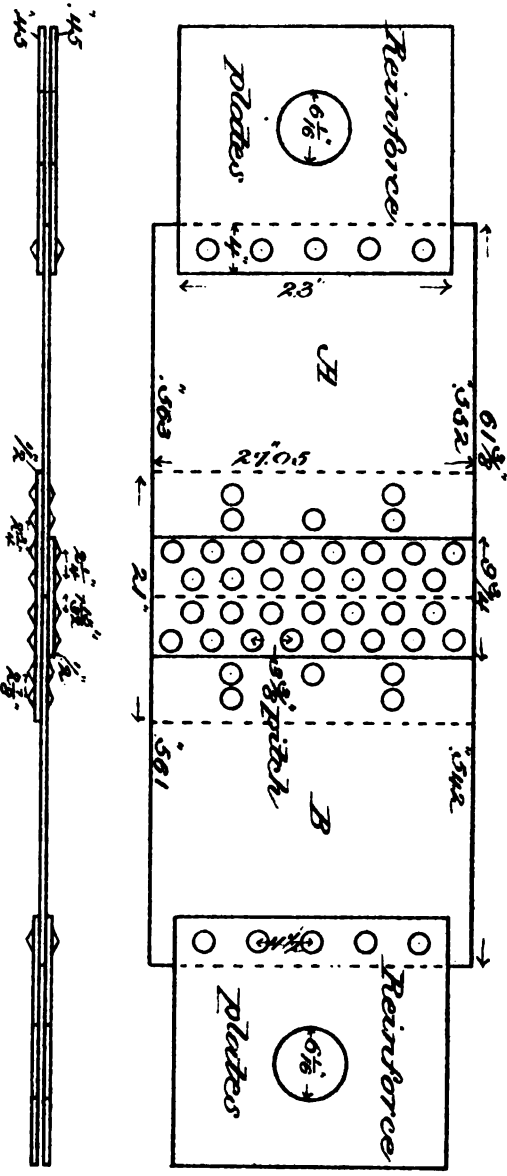
The plates were drawn down in width to 26".80 and 26".78, thus showing contractions of ".20 and ".22 respectively.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	42,440
Tension on net section of plate	do.....	46,110
Compression on bearing surface of rivets	do.....	61,240
Shearing on rivets.....	do.....	26,500

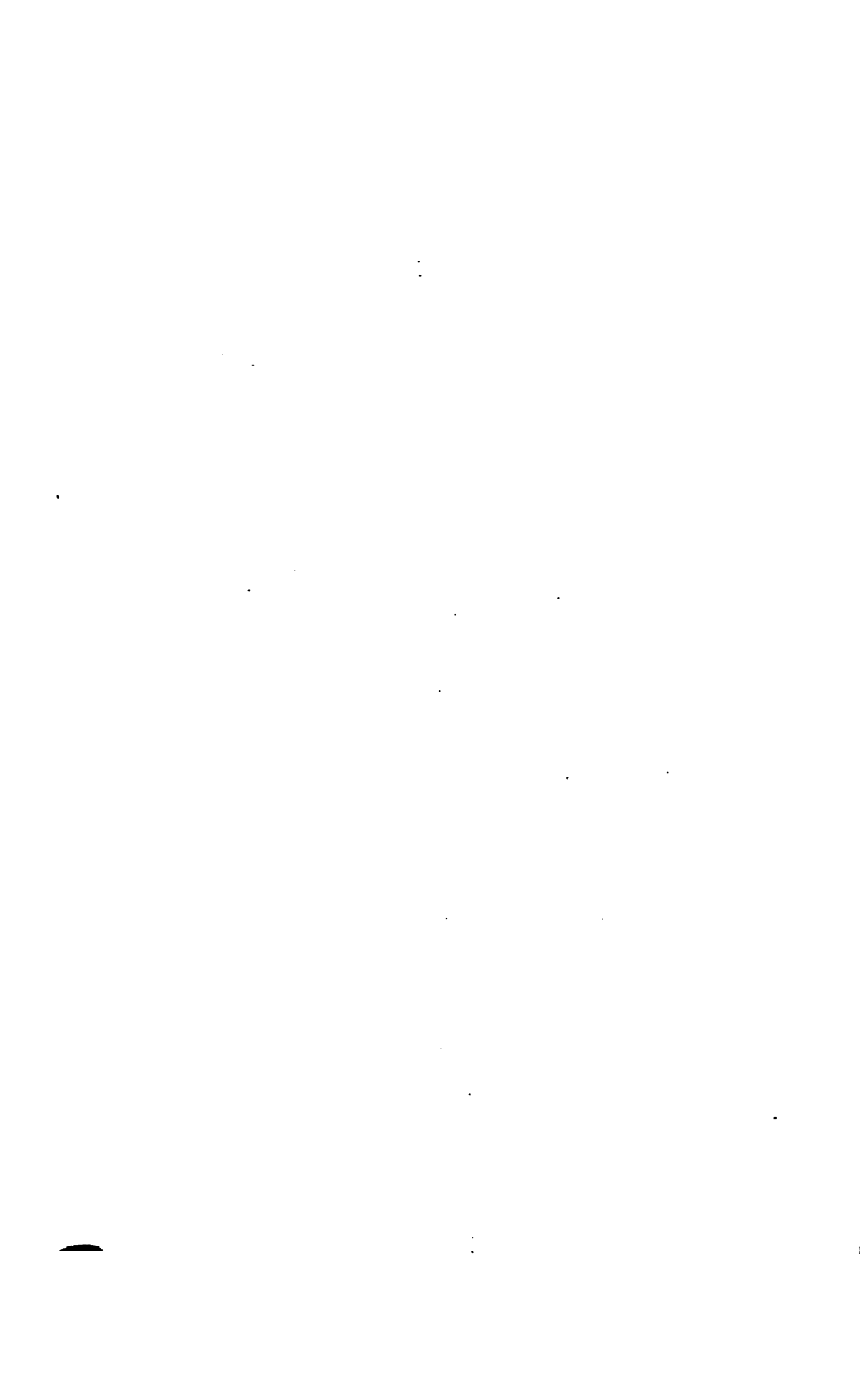
Efficiency of joint, 71.1 per cent.

No. 9437

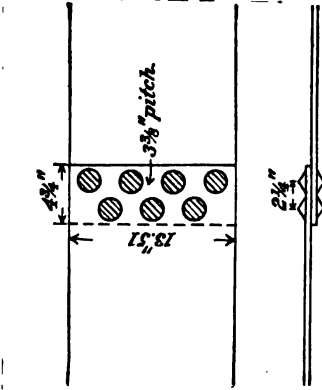


$\frac{5}{8}$ " steel rods

$\frac{1}{8}$ " drilled holes.



TABLATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.			Efficiency of joint.	
				Gross.	Net.				Tension on gross section of plate.	Tension on net bearing surface of plate.	Compression on bearing surface of rivets.		Shearing on rivets.
		Inch.		Sq. in.	Sq. in.	Sq. in.	Sq. in.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Per cent.
9874		$\frac{5}{16}$	$\frac{3}{8}$ steel rivets, $\frac{13}{16}$ drilled holes.	7.17	5.18	3.48	4.83	59,680	28,130	38,940	57,960	41,760	47.1

TABLATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

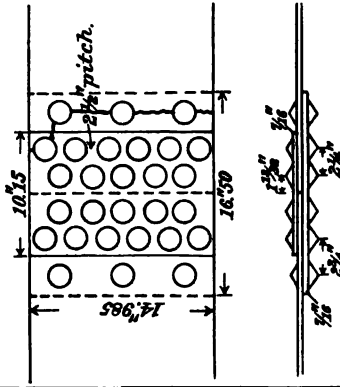
No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing surface of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.				Efficiency of joint.
				Gross.	Net.			Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
		Inch.		Sq. in.	Sq. in.	Sq. in.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Per cent.
9377		$\frac{1}{16}$	$\frac{3}{8}$ " steel rivets, $\frac{11}{16}$ " drilled holes.	14.44	12.44	6.02	59,680	33,990	39,450	81,530	35,560	57.0

<p>Diagram of riveted joint 8507. It shows a 10" x 10" grid of rivets. The cross-section shows a 10 1/2" wide plate with 10 1/8" spacing between rivets. Rivet pitch is indicated as 2 1/2" pitch.</p>	<p>1</p> <p>.....do</p>	<p>4.91</p> <p>3.99</p> <p>4.14</p> <p>11.04</p> <p>60,550</p> <p>50,550</p> <p>62,300</p> <p>59,950</p> <p>22,480</p>	<p>83.5</p>
<p>Diagram of riveted joint 8508. It shows a 10" x 10" grid of rivets. The cross-section shows a 16 1/2" wide plate with 13 1/8" spacing between rivets. Rivet pitch is indicated as 3 1/8" pitch.</p>	<p>1</p> <p>.....do</p>	<p>6.73</p> <p>5.90</p> <p>4.20</p> <p>11.04</p> <p>60,550</p> <p>48,620</p> <p>56,410</p> <p>77,900</p> <p>26,640</p>	<p>80.3</p>

8507

8508

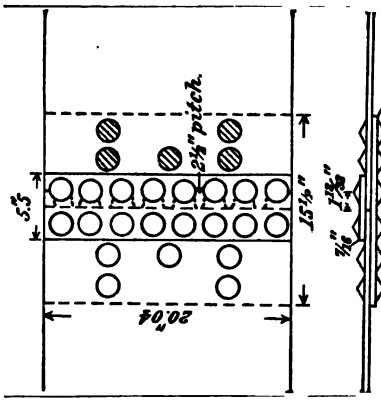
RIVETED JOINTS.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Tensile strength of plate per square inch.	Maximum stress on joint per square inch.			Efficiency of joint.	
				Gross.	Net.		Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.		Shearing on rivets.
8515		Inch.	1/2" steel rivets, 1 1/2" drilled holes.	7.05	5.73	59,800	51,205	63,000	58,510	20,830	85.5

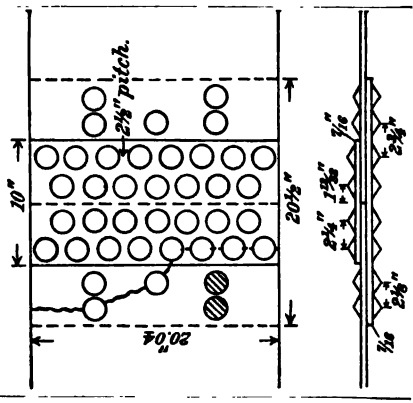
TABULATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Tensile strength of plate per square inch.	Maximum stress on joint per square inch.			Efficiency of joint.
				Gross.	Net.		Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	
		Inch.		Sq. in.	Sq. in.	Pounds.	Pounds.	Pounds.	Pounds.	Per cent.
9436		$\frac{1}{2}$	$\frac{1}{2}$ " steel rivets, $\frac{3}{8}$ " drilled holes.	14.77	12.72	59,680	47,407	55,060	71,890	79.4

.....do.....	11.22	10.17	6.82	14.49	59,080	46,530	51,340	76,560	36,080	78.0
.....do.....	10.70	9.63	10.01	24.15	59,080	46,930	52,150	50,170	20,790	78.6



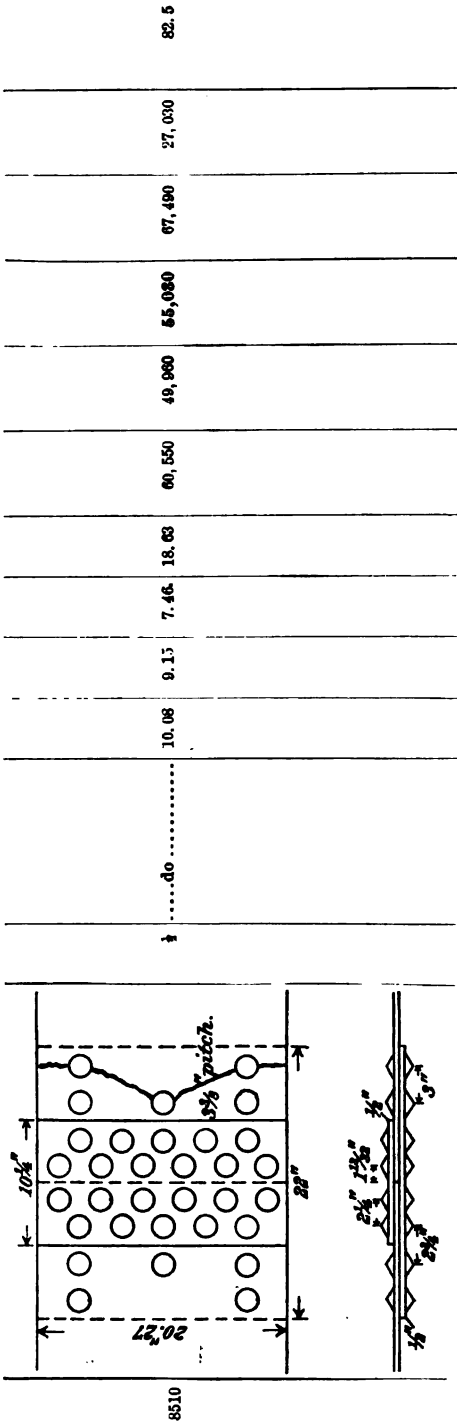
9376



9375

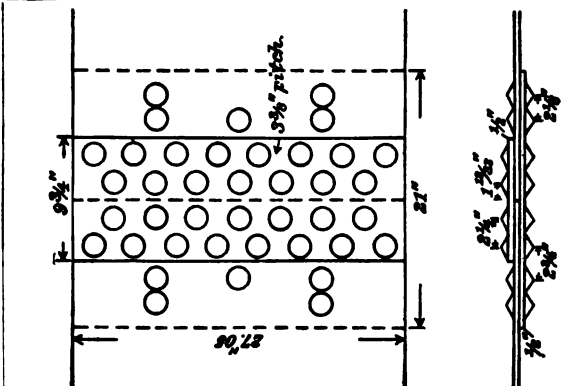
TABULATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing sur. face of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.				Efficiency of joint.
				Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
8508		1/2	3/4" steel rivets, 1/4" drilled holes.	7.95	6.43	7.34	18.63	60,550	54,580	62,890	51,060	21,530	90.1
8509		3/16	do	7.49	6.56	7.48	18.63	60,530	51,282	58,550	51,350	20,620	84.7



8510	10.08	9.13	7.46	18.63	60,550	49,960	55,080	67,490	27,030	82.5
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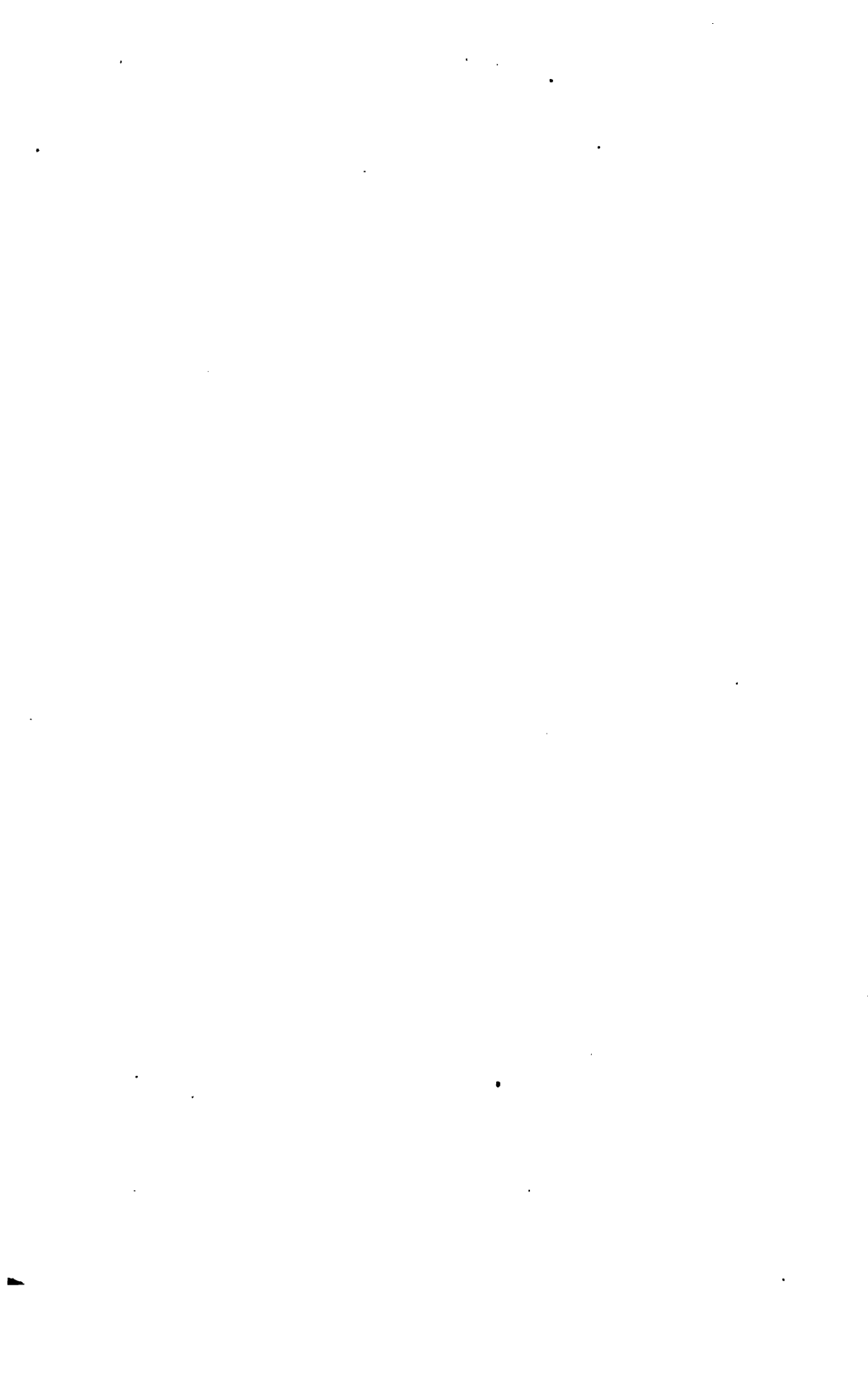
TABULATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.			Efficiency of joint.
				Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression bearing surface of rivets.		Shearing on rivets.
		Inch.		Sq. in.	Sq. in.	Sq. in.	Sq. in.	Pounds.	Pounds.	Pounds.	Pounds.	Per cent.
9437		$\frac{3}{8}$	$\frac{3}{8}$ steel rivets, $\frac{11}{16}$ drilled holes.	15.08	13.88	10.45	24.15	59,060	42,440	46,110	61,240	71.1

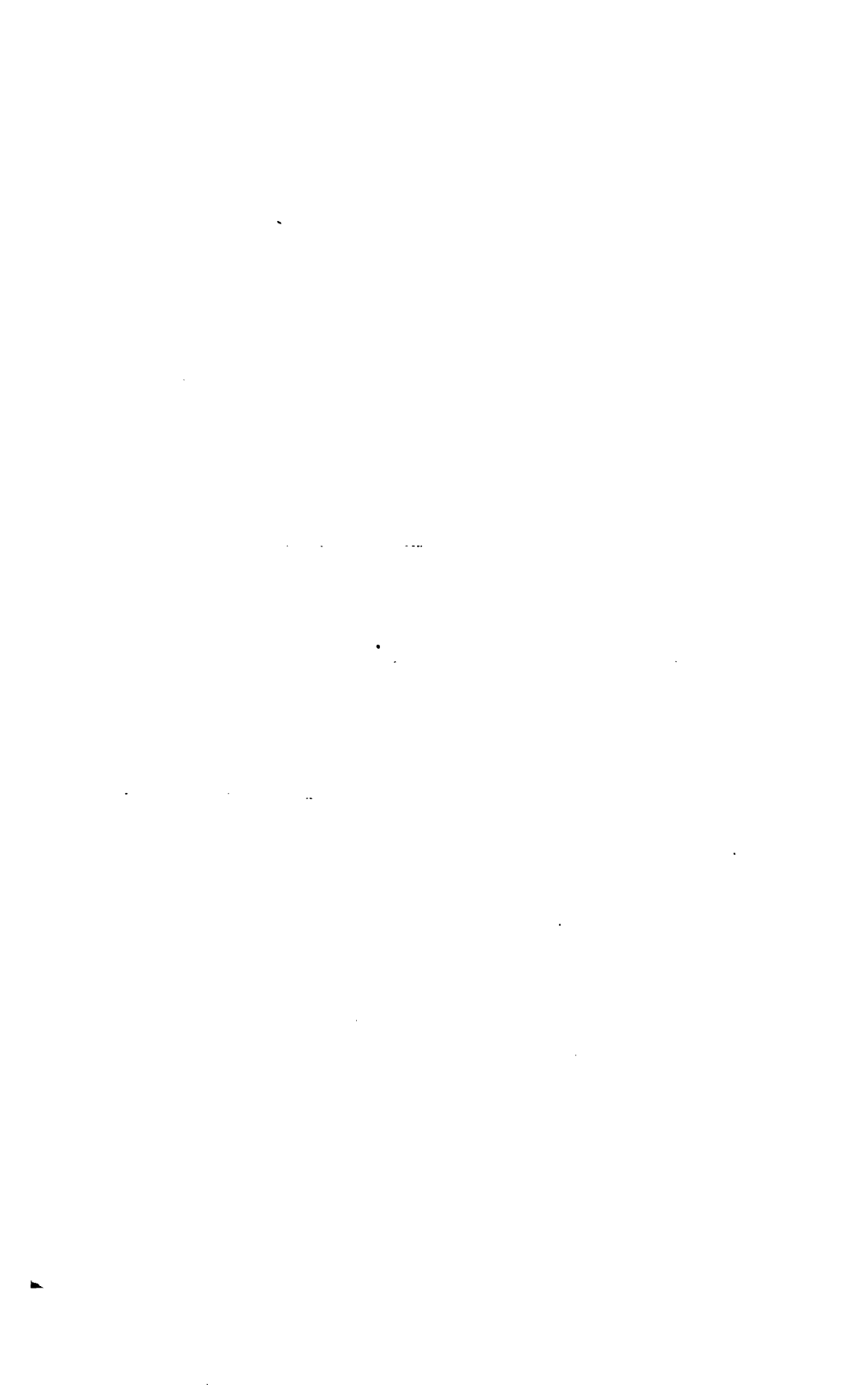
Joint No. 8508 tested hot. Temperature about 410° F.

Joints Nos. 9436 and 9437 were not fractured. Stresses computed and efficiencies given for the maximum loads which were reached.

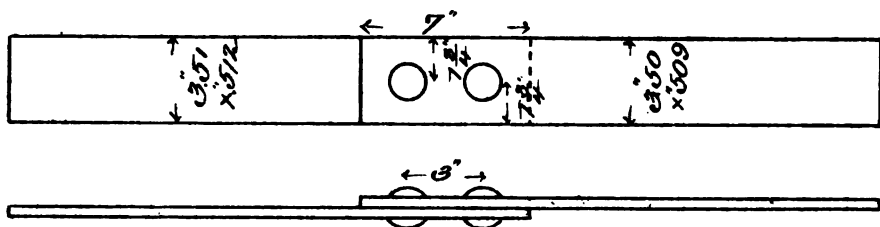
Figures in heavy-faced type denote the manner of failure.



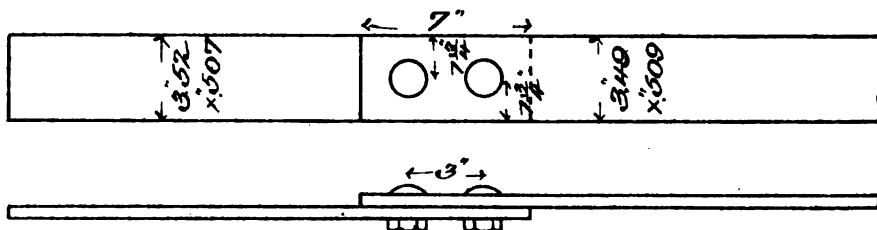
RIVETED AND BOLTED JOINTS.



Nos. 9146 and 9147.



Nos. 9148 and 9149.



RIVETED AND BOLTED JOINTS.

These joints were designed and prepared by the Berlin Iron Bridge Company, of East Berlin, Conn., who contributed the material for testing.

No. 9146.

Marks, B 1.

$\frac{1}{4}$ " steel plate, $\frac{3}{4}$ " steel rivets.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of plate, $3''.51 \times '.512 = 1.797$ square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	0.	0.	Initial load.
1,0000003	.....
1,5000005	.....
2,0000007	.....
2,5000009	.....
3,0000010	.....
4,0000011	.....
5,0000012	.....
6,0000014	.....
7,0000019	.....
8,0000020	.....
9,0000022	.....
10,0000027	.....
11,0000029	.....
12,0000031	.....
13,0000038	.....
14,0000040	.....
15,0000045	.....
16,0000049	.....
17,0000053	.....
18,0000061	.....
19,0000069	.....
20,0000080	.....
21,0000091	.....
22,0000118	.....
23,0000181	.....
24,0000200	.....
25,0000211	.....
26,0000221	.....
28,0000241	.....
30,0000500	.....
32,0000420	.....
48,510	26,990	Tensile strength.

Sheared the rivets; started cracks in plates.

No. 9147.

Marks, B 2.

 $\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " iron rivets.Punched holes; punch $\frac{13}{16}$ ", die $\frac{7}{8}$ " diameter.Gross sectional area of plate, $3''.50 \times .509 = 1.781$ square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	0.	0.	
1,0000000	.....
1,5000001	.....
2,0000003	.....
2,5000005	.....
3,0000007	.....
4,0000009	.....
5,0000012	.....
6,0000016	.....
7,0000020	.....
8,0000023	.....
9,0000026	.....
10,0000028	.....
11,0000029	.....
12,0000032	.....
13,0000038	.....
14,0000040	.....
15,0000042	.....
16,0000047	.....
17,0000049	.....
18,0000052	.....
19,0000059	.....
20,0000061	.....
21,0000068	.....
22,0000072	.....
23,0000078	.....
24,0000085	.....
25,0000095	.....
26,0000107	.....
27,0000128	.....
28,0000182	.....
29,0000200	.....
30,0000217	.....
32,0000251	.....
34,0000710	.....
46,520	26,120	Tensile strength.

Sheared the rivets; started cracks in plates.

No. 9148.

Marks, B 3.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " steel bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of plate, $3''.52 \times .507$ square inches.. 1.785

Shearing area of bolts, $\frac{7}{8}$ " diameter..... do.... .837

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	0.	0.	
1,0000002	.....
1,5000006	.....
2,0000011	.....
2,5000015	.....
3,0000019	.....
4,0000069	.....
5,0000135	.....
6,0000220	.....
7,0000319	.....
8,0000518	.....
9,0000590	.....
10,0001150	.....
37,690	{ 21,110	Tensile strength; sheared the bolts. Shearing strength of bolts.
	45,030	.....	.....

No. 9149.

Marks, B 4.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of plate $3''.49 \times .509$ square inches.. 1.776

Shearing area of bolts $\frac{7}{8}$ " diameter..... do.... .837

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	0.	0.	
1,0000009	.....
1,5000048	.....
2,0000130	.....
2,5000182	.....
3,0000240	.....
4,0000750	.....
5,0000820	.....
6,0000925	.....
7,0001005	.....
8,0001091	.....
9,0001142	.....
10,0001209	.....
33,200	{ 18,690	Tensile strength; sheared the bolts. Shearing strength of bolts.
	39,690	.....	.....

No. 9150.

Marks, B 9.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " steel rivets.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{1}{8}$ " diameter.

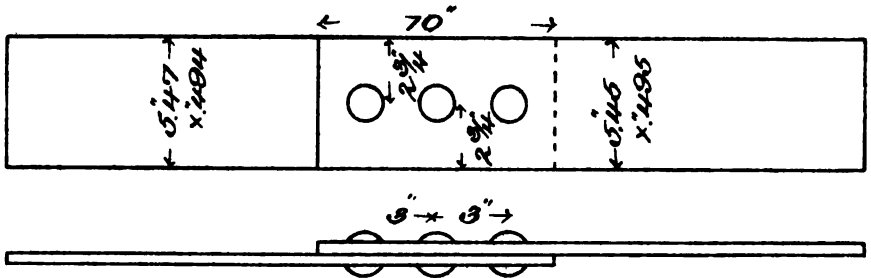
Gross sectional area of plate, $5''.47 \times '''.494 = 2.702$ square inches.

Gauged length, 6".

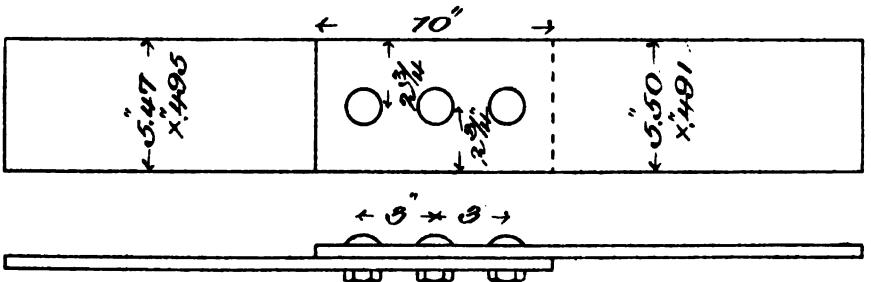
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	0.	0.	Initial load.
1,0000000	.....
1,5000000	.....
2,0000001	.....
2,5000001	.....
3,0000001	.....
4,0000002	.....
5,0000002	.....
6,0000005	.....
7,0000007	.....
8,0000009	.....
9,0000010	.....
10,0000012	.....
11,0000014	.....
12,0000016	.....
13,0000018	.....
14,0000021	.....
16,0000024	.....
18,0000030	.....
20,0000034	.....
22,0000040	.....
24,0000047	.....
26,0000055	.....
28,0000061	.....
30,0000077	.....
32,0000082	.....
34,0000121	.....
36,0000160	.....
38,0000178	.....
40,0000190	.....
42,0000200	.....
44,0000212	.....
46,0000241	.....
48,0000275	.....
50,0000480	Tensile strength.
79,960	29,590	.....	.....

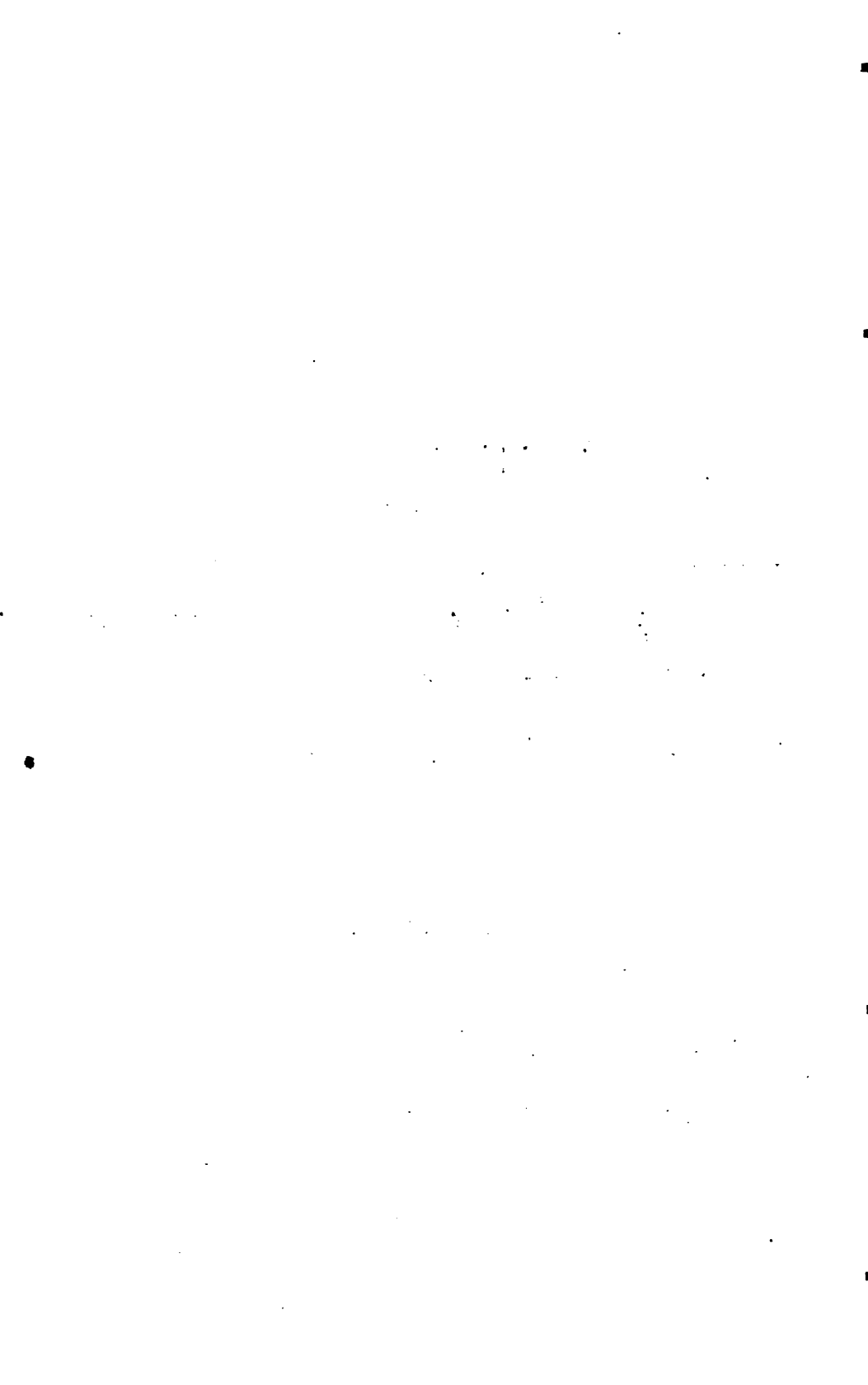
Sheared the rivets.

Nos. 9150 and 9151.



Nos. 9152 and 9153.





No. 9151.

Marks, B 10.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " iron rivets.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of plate, $5''.45 \times '' .495 = 2.698$ square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	Initial load.
1,000		.0000		
1,500		.0000		
2,000		.0001		
2,500		.0001		
3,000		.0002		
4,000		.0003		
5,000		.0005		
6,000		.0006		
7,000		.0008		
8,000		.0009		
9,000		.0010		
10,000		.0011		
11,000		.0011		
12,000		.0013		
13,000		.0015		
14,000		.0017		
16,000		.0021		
18,000		.0023		
20,000		.0027		
22,000		.0030		
24,000		.0035		
26,000		.0040		
28,000		.0045		
30,000		.0052		
32,000		.0060		
34,000		.0071		
36,000		.0085		
38,000		.0110		
40,000		.0160		
42,000		.0171		
44,000		.0188		
46,000		.0200		
48,000		.0440		
65,600	24,310			Tensile strength.

Sheared the rivets.

No. 9152.

Marks, B 11.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " steel bolts.

Punched holes; punch $\frac{1}{8}$ ", die, $\frac{7}{8}$ " diameter.

Gross sectional area of plate, $5'' .47 \times '' .495$ square inches... 2.708

Shearing area of bolts, $'' .73$ diameter do.... 1.255

Gauged length, 6''.

Applied loads.		In ganged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	0.	0.	Initial load.
1,0000001	.....
1,5000003	.....
2,0000004	.....
2,5000008	.....
3,0000040	.....
4,0000065	.....
5,0000140	.....
6,0000240	.....
7,0000330	.....
8,0000468	.....
9,0000678	.....
10,0000842	.....
11,0000915	.....
12,0000970	.....
13,0001021	.....
14,0001075	.....
16,0001169	.....
18,0001250	.....
20,0001328	.....
58,120	{ 21,480	Tensile strength. Shearing strength of bolts.
	{ 46,810	.....	.....

Sheared the bolts.

No. 9153.

Marks, B 12.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of plate, $5'' \times .50 \times '' .491$ square inches.. 2.700

Shearing area of bolts, $\frac{7}{8}$ " diameter.....do..... 1.255

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	0.	0.	Initial load.
1,0000000	.....
1,5000001	.....
2,0000003	.....
2,5000007	.....
3,0000010	.....
4,0000018	.....
5,0000041	.....
6,0000068	.....
7,0000100	.....
8,0000142	.....
9,0000191	.....
10,0000249	.....
11,0000319	.....
12,0000390	.....
13,0000461	.....
14,0000515	.....
16,0000644	.....
18,0000775	.....
20,0000880	.....
22,0000988	.....
24,0001080	.....
26,0001241	.....
48,850	{ 18,090	Tensile strength. Shearing strength of bolts.
	38,920	.....	.....

Sheared the bolts.

No. 9154.

Marks, B 17.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " steel rivets.

Punched holes; punch $\frac{1}{2}$ ", die $\frac{7}{8}$ " diameter.

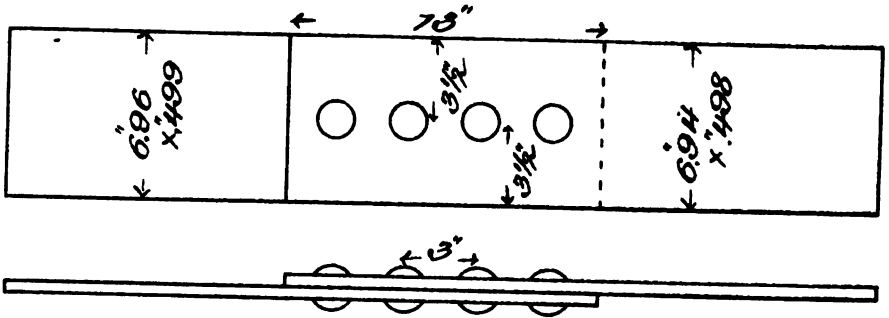
Gross sectional area of plate, $6''.96 \times '.499 = 3.473$ square inches.

Gauged length, 6".

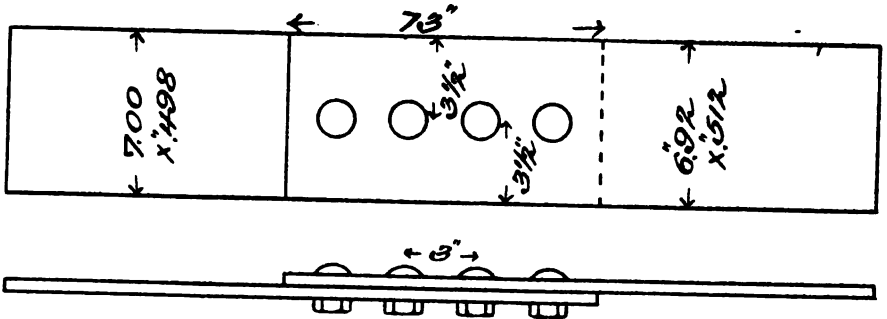
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i> 0.	<i>Inch.</i> 0.	
500	Initial load.
1,0000000	.....
2,0000001	.....
3,0000001	.....
4,0000002	.....
5,0000002	.....
6,0000003	.....
7,0000004	.....
8,0000007	.....
9,0000010	.....
10,0000012	.....
11,0000013	.....
12,0000016	.....
13,0000018	.....
14,0000020	.....
15,0000021	.....
16,0000023	.....
18,0000030	.....
20,0000034	.....
22,0000041	.....
24,0000049	.....
26,0000056	.....
28,0000064	.....
30,0000074	.....
32,0000088	.....
34,0000110	.....
36,0000124	.....
38,0000160	.....
40,0000172	.....
42,0000188	.....
44,0000200	.....
46,0000204	.....
48,0000212	.....
50,0000221	.....
52,0000231	.....
54,0000241	.....
56,0000252	.....
58,0000262	.....
60,0000310	.....
62,0000450	.....
64,0000550	.....
66,0000610	.....
100,100	28,820	Tensile strength.

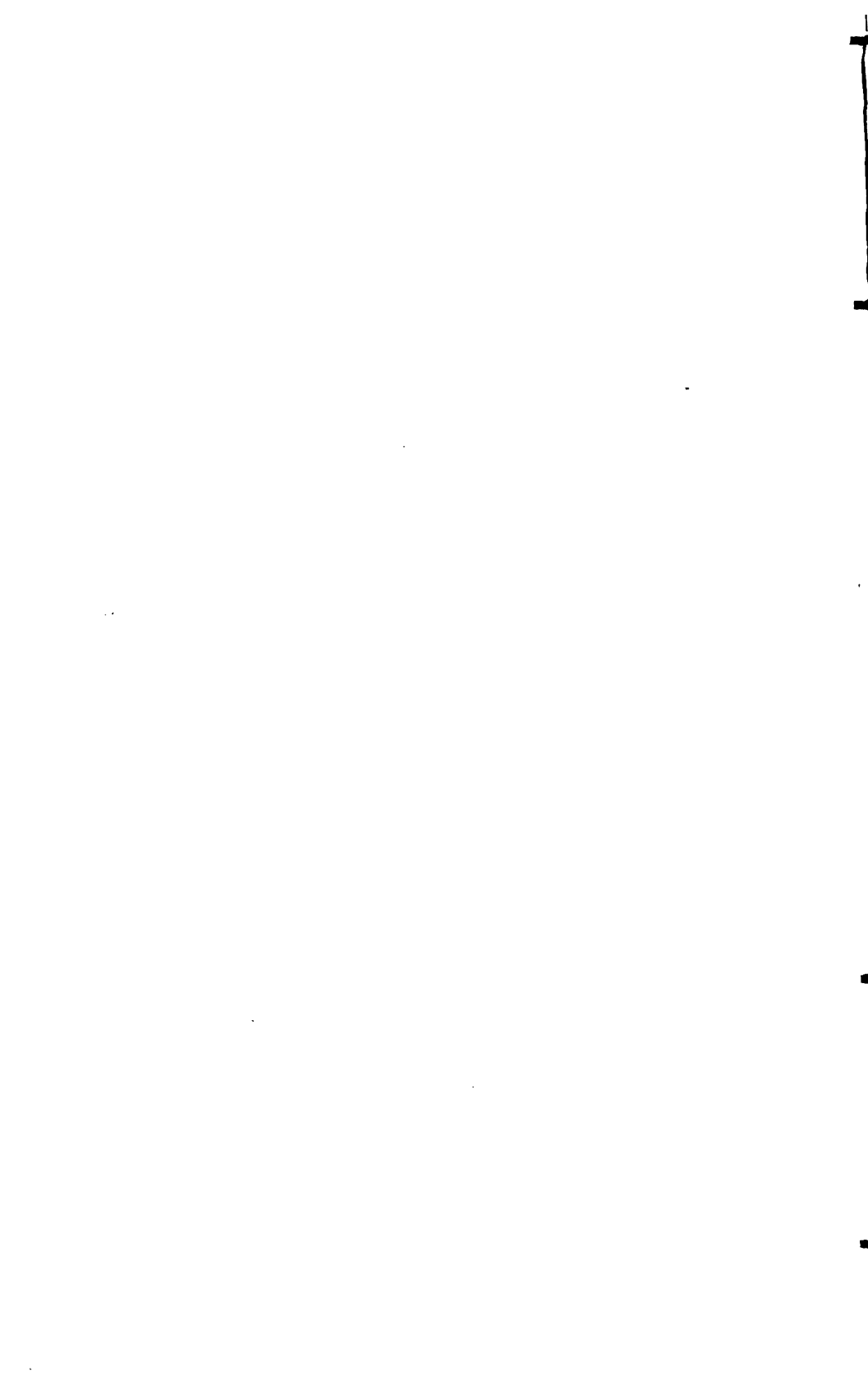
Sheared the rivets.

Nos. 9154 and 9155.



Nos. 9156 and 9157.





No. 9155.

Marks, B 18.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " iron rivets.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of plate, $6''.94 \times '.498 = 3.456$ square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch. 0.	Inch. 0.	
500	
1,0000000	.....
2,0000000	.....
3,0000001	.....
4,0000002	.....
5,0000003	.....
6,0000004	.....
7,0000006	.....
8,0000007	.....
9,0000009	.....
10,0000010	.....
11,0000010	.....
12,0000011	.....
13,0000012	.....
14,0000014	.....
15,0000016	.....
16,0000018	.....
18,0000020	.....
20,0000022	.....
22,0000026	.....
24,0000030	.....
26,0000032	.....
28,0000037	.....
30,0000040	.....
32,0000044	.....
34,0000048	.....
36,0000054	.....
38,9000062	.....
40,0000068	.....
42,0000075	.....
44,0000085	.....
46,0000098	.....
48,0000125	.....
50,0000172	.....
52,0000182	.....
54,0000192	.....
56,0000201	.....
58,0000218	.....
60,0000530	.....
62,0000580	.....
64,0000629	.....
66,0000688	.....
91,400	28,450	.....	.....	Tensile strength.

Sheared the rivets.

No. 9156.

Marks, B 19.

$\frac{1}{4}$ " steel plate, $\frac{3}{4}$ " steel bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of plate, $7'' \times '' .498$square inches... 3.486

Shearing area of bolts, $\frac{7}{8}$ " diameter.....do.... 1.674

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
500	0.	0.		
1,0000000	.....	
2,0000001	.....	
3,0000006	.....	
4,0000008	.....	
5,0000016	.....	
6,0000033	.....	
7,0000065	.....	
8,0000116	.....	
9,0000580	.....	
10,0000660	.....	
11,0000790	.....	
12,0000851	.....	
13,0000902	.....	
14,0000951	.....	
15,0000990	.....	
16,0001022	.....	
18,0001153	.....	
20,0001261	.....	
22,0001353	.....	
24,0001413	.....	
76,900	{ 22,060		Tensile strength.
	{ 45,840		Shearing strength of bolts.

Sheared the bolts.

No. 9157.

Marks, B 20.

$\frac{1}{2}$ " steel plate, $\frac{3}{4}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of plate, $6''.92 \times '' .512$ square inches.. 3.543

Shearing area of bolts, $'' .73$ diameter do..... 1.674

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.	0.	Initial load.
1,000		.0000		
2,000		.0001		
3,000		.0003		
4,000		.0008		
5,000		.0032		
6,000		.0073		
7,000		.0290		
8,000		.0470		
9,000		.0650		
10,000		.0850		
11,000		.0738		
12,000		.0835		
13,000		.0880		
14,000		.0935		
15,000		.0979		
16,000		.1000		
18,000		.1070		
20,000		.1112		
22,000		.1173		
24,000		.1238		
26,000		.1290		
28,000		.1355		
30,000		.1418		
72,510	{ 20,470			Tensile strength.
	{ 43,310			Shearing strength of bolts.

Sheared the bolts.

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No. 9158.

Marks, B 5.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " steel rivets.

Punched holes; punch $\frac{13}{16}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $4''.08 \times '.745$ square inches.. 3.040

Net sectional area of web plate, $2''.39 \times '.745$ do..... 1.780

Gauged length, 6".

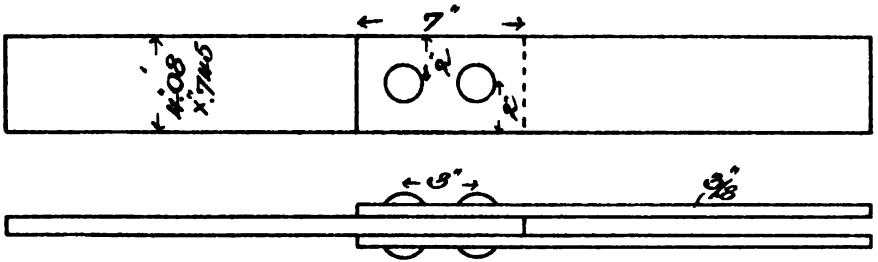
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	0.	0.	
1,0000000	.....
2,0000000	.....
3,0000001	.....
4,0000002	.....
5,0000003	.....
6,0000004	.....
7,0000005	.....
8,0000006	.....
9,0000008	.....
10,0000009	.....
11,0000010	.....
12,0000010	.....
13,0000011	.....
14,0000011	.....
15,0000012	.....
16,0000012	.....
18,0000015	.....
20,0000017	.....
22,0000020	.....
24,0000021	.....
26,0000024	.....
28,0000026	.....
30,0000028	.....
32,0000032	.....
34,0000045	.....
36,0000061	.....
38,0000070	.....
40,0000079	.....
42,0000086	.....
44,0000091	.....
46,0000098	.....
48,0000102	.....
50,0000111	.....
52,0000120	.....
54,0000129	.....
56,0000143	.....
58,0000228	.....
60,0000412	.....
62,0000445	.....
64,0000498	.....
66,0000530	.....
68,0000580	.....
70,0000621	.....
89,800	29,540	.....	.....	Tensile strength.

Fractured web plate.
Granular.

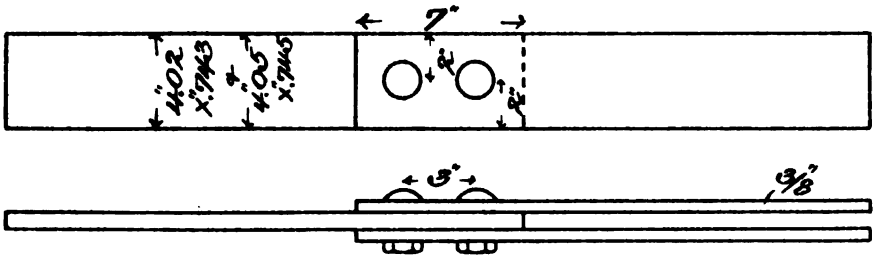
Maximum stress on joint.

Tension on gross section of platepounds per square inch.. 29,540
Tension on net section of platedo..... 50,450

Nos. 9158 and 9159.



Nos. 9160 and 9161.





No. 9159.

Marks, B 6.

 $\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " iron rivets.Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.Gross sectional area of web plate, $4''.08 \times .745 = 3.040$ square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	Initial load.
1,000		.0000		
2,000		.0001		
3,000		.0002		
4,000		.0003		
5,000		.0004		
6,000		.0004		
7,000		.0005		
8,000		.0006		
9,000		.0006		
10,000		.0007		
11,000		.0007		
12,000		.0008		
13,000		.0008		
14,000		.0009		
15,000		.0010		
16,000		.0012		
18,000		.0014		
20,000		.0016		
22,000		.0018		
24,000		.0019		
26,000		.0021		
28,000		.0024		
30,000		.0027		
32,000		.0036		
34,000		.0050		
36,000		.0060		
38,000		.0069		
40,000		.0076		
42,000		.0084		
44,000		.0088		
46,000		.0093		
48,000		.0098		
50,000		.0107		
52,000		.0119		
54,000		.0138		
56,000		.0161		
58,000		.0229		
60,000		.0420		
62,000		.0446		
64,000		.0494		
66,000		.0543		
68,000		.0576		
70,000		.0631		
90,200	29,670			Tensile strength.

Sheared the rivets.

No. 9160.

Marks, B 7.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " steel bolts.

Punched holes; punch $\frac{13}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $4''.02 \times \dots$ square inches.. 2.987

Shearing area of bolts, \dots do..... 1.674

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.0000	0.	Initial load.
1,000		.0011		
2,000		.0700		
3,000		.0739		
4,000		.0855		
5,000		.1030		
6,000		.1170		
7,000		.1212		
8,000		.1280		
9,000		.1322		
10,000		.1371		
11,000		.1412		
12,000		.1452		
13,000		.1500		
14,000		.1550		
15,000		.1610		
16,000		.1669		
18,000		.1765		
20,000		.1823		
22,000		.1880		
24,000		.1940		
26,000		.2000		
28,000		.2058		
30,000		.2125		
32,000		.2190		
34,000		.2250		
36,000		.2315		
38,000		.2380		
40,000		.2459		
42,000		.2520		
44,000		.2583		
46,000		.2650		
48,000		.2723		
50,000				Tensile strength.
59,900	20,050			Shearing strength of bolts.
	35,780			

Sheared bolts in one plane.

No. 9161.

Marks, B 8.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " iron bolts.

Punched holes; punch $\frac{13}{16}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $4''.05 \times '' .745$square inches. 3.017

Shearing area of bolts, $'' .73$ diameter.....do..... 1.674

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	Initial load.
1,000		.0000		
2,000		.0001		
3,000		.0001		
4,000		.0005		
5,000		.0007		
6,000		.0013		
7,000		.0028		
8,000		.0072		
9,000		.0119		
10,000		.0170		
11,000		.0211		
12,000		.0229		
13,000		.0251		
14,000		.0281		
15,000		.0330		
16,000		.0410		
18,000		.0518		
20,000		.0580		
22,000		.0631		
24,000		.0690		
26,000		.0743		
28,000		.0805		
30,000		.0878		
32,000		.0938		
34,000		.1018		
36,000		.1110		
38,000		.1200		
40,000		.1288		
42,000		.1383		
44,000		.1440		
46,000		.1552		
48,000		.1655		
50,000		.1760		
54,300	18,000			Tensile strength.
	32,440				Shearing strength of bolts.

Sheared the bolts in both planes.

No. 9162.

Marks, B 13.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " steel rivets.

Punched holes; punch $\frac{13}{16}$ ", die $\frac{7}{8}$ " diameter.

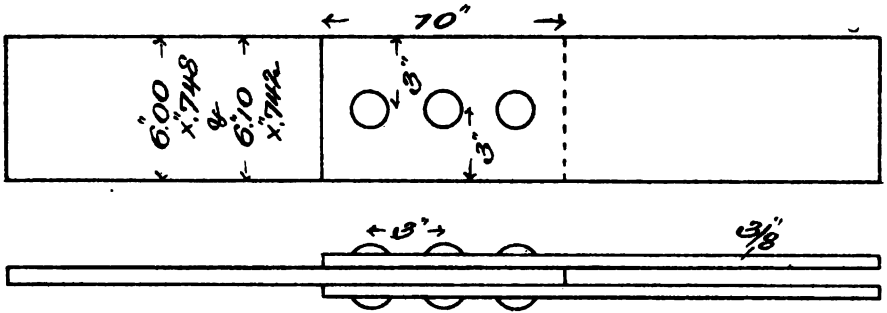
Gross sectional area of web plate, $6'' \times .748 = 4.488$ square inches.

Gauged length, 6''.

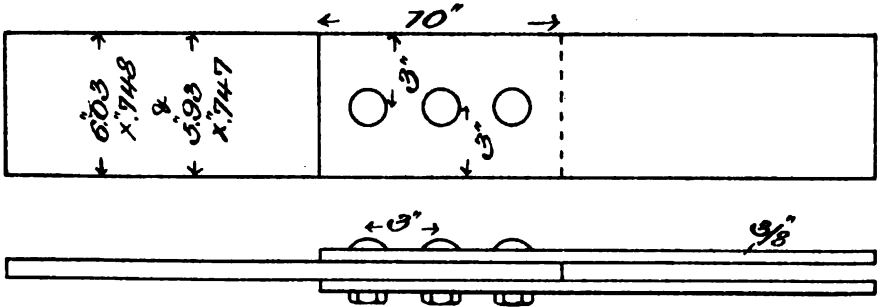
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	0.	0.	Initial load.
1,0000000	.....
2,0000001	.....
3,0000001	.....
4,0000001	.....
5,0000002	.....
6,0000003	.....
7,0000004	.....
8,0000004	.....
9,0000005	.....
10,0000006	.....
12,0000008	.....
14,0000009	.....
16,0000010	.....
18,0000012	.....
20,0000014	.....
22,0000015	.....
24,0000017	.....
26,0000019	.....
28,0000021	.....
30,0000024	.....
32,0000027	.....
34,0000035	.....
36,0000060	.....
38,0000065	.....
40,0000071	.....
42,0000075	.....
44,0000078	.....
46,0000085	.....
48,0000090	.....
50,0000100	.....
52,0000121	.....
54,0000136	.....
56,0000151	.....
58,0000163	.....
60,0000176	.....
62,0000182	.....
64,0000189	.....
66,0000198	.....
68,0000201	.....
70,0000200	.....
72,0000242	.....
74,0000318	.....
76,0000350	.....
78,0000380	.....
80,0000430	.....
139,300	31,040	Tensile strength.

Sheared the rivets.

Nos. 9162 and 9163



Nos. 9164 and 9165





No. 9163.

Marks, B 14.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " iron rivets.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $6'' \cdot 10 \times '' \cdot 742 = 4.526$ square inches.

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch. 6.	Inch. 0.	
500				Initial load.
1,000		.0000		
2,000		.0001		
3,000		.0001		
4,000		.0003		
5,000		.0004		
6,000		.0005		
7,000		.0005		
8,000		.0006		
9,000		.0006		
10,000		.0007		
12,000		.0008		
14,000		.0009		
16,000		.0010		
18,000		.0010		
20,000		.0011		
22,000		.0012		
24,000		.0013		
26,000		.0014		
28,000		.0014		
30,000		.0015		
32,000		.0016		
34,000		.0018		
36,000		.0020		
38,000		.0022		
40,000		.0022		
42,000		.0023		
44,000		.0024		
46,000		.0026		
48,000		.0030		
50,000		.0060		
52,000		.0066		
54,000		.0070		
56,000		.0075		
58,000		.0081		
60,000		.0085		
62,000		.0090		
64,000		.0093		
66,000		.0096		
68,000		.0101		
70,000		.0110		
72,000		.0118		
74,000		.0125		
76,000		.0133		
78,000		.0171		
80,000		.0199		
82,000		.0218		
84,000		.0345		
86,000		.0380		
129,100	28,520			Tensile strength.

Sheared the rivets.

No. 9164.

Marks, B 15.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " steel bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $6'' \times .03 \times .748$square inches.. 4.510

Shearing area of bolts, $\frac{7}{8}$ " diameter.....do..... 2.511

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	Initial load.
1,000		.0000		
2,000		.0000		The nuts were not screwed down very hard.
3,000		.0001		
4,000		.0002		
5,000		.0005		
6,000		.0180		
7,000		.0201		
8,000		.0238		
9,000		.0269		
10,000		.0290		
12,000		.0356		
14,000		.0400		
16,000		.0431		
18,000		.0465		
20,000		.0495		
22,000		.0534		
24,000		.0590		
26,000		.0650		
28,000		.0719		
30,000		.0766		
32,000		.0810		
34,000		.0852		
36,000		.0900		
38,000		.0933		
40,000		.0972		
42,000		.1017		
44,000		.1060		
46,000		.1109		
48,000		.1160		
50,000		.1212		
52,000		.1255		
54,000		.1310		
56,000		.1355		
58,000		.1390		
60,000		.1456		
62,000		.1490		
64,000		.1531		
66,000		.1565		
68,000		.1610		
70,000		.1650		
112,800	{ 25,010 44,920			Tensile strength; sheared the bolts. Shearing strength of bolts.

No. 9165.

Marks, B 16.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " iron bolts.

Punched holes; punch $\frac{13}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $5'' .93 \times '' .747$square inches.. 4.430

Shearing area of bolts, $'' .73$ diameter.....do..... 2.511

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Klongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.	0.	Initial load.
1,000		.0000		
2,000		.0000		The nuts were screwed down hard.
3,000		.0001		
4,000		.0002		
5,000		.0004		
6,000		.0006		
7,000		.0010		
8,000		.0012		
9,000		.0150		
10,000		.0199		
12,000		.0325		
14,000		.0364		
16,000		.0480		
18,000		.0522		
20,000		.0559		
22,000		.0590		
24,000		.0622		
26,000		.0675		
28,000		.0719		
30,000		.0760		
32,000		.0820		
34,000		.0889		
36,000		.0940		
38,000		.1002		
40,000		.1051		
42,000		.1117		
44,000		.1180		
46,000		.1220		
48,000		.1290		
50,000		.1322		
52,000		.1380		
54,000		.1426		
56,000		.1480		
58,000		.1540		
60,000		.1600		
62,000		.1652		
64,000		.1721		
66,000		.1772		
68,000		.1830		
70,000		.1900		
78,500	{ 17,720 31,260			Tensile strength; sheared the bolts. Shearing strength of bolts.

No. 9166.

Marks, B 21.

 $\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " steel rivets.Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.Gross sectional area of web plate, $8''.04 \times '' .753$ square inches.. 6.054Net sectional area of covers, $7.196 \times .716$ do.... 5.152

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.	0.	Initial load.
1,000		.0000		
2,000		.0000		
3,000		.0000		
4,000		.0000		
5,000		.0000		
6,000		.0000		
7,000		.0000		
8,000		.0000		
9,000		.0001		
10,000		.0001		
12,000		.0002		
14,000		.0002		
16,000		.0004		
18,000		.0005		
20,000		.0006		
24,000		.0009		
28,000		.0011		
32,000		.0012		
36,000		.0015		
40,000		.0020		
44,000		.0028		
48,000		.0068		
52,000		.0072		
56,000		.0084		
60,000		.0093		
64,000		.0100		
68,000		.0115		
72,000		.0122		
76,000		.0130		
80,000		.0140		
84,000		.0151		
88,000		.0160		
92,000		.0175		
96,000		.0190		
100,000		.0203		
104,000		.0224		
108,000		.0241		
112,000		.0278		
116,000		.0310		
120,000		.0353		
124,000		.0390		
128,000		.0424		
132,000		.0480		
175,400	28,970			Tensile strength.

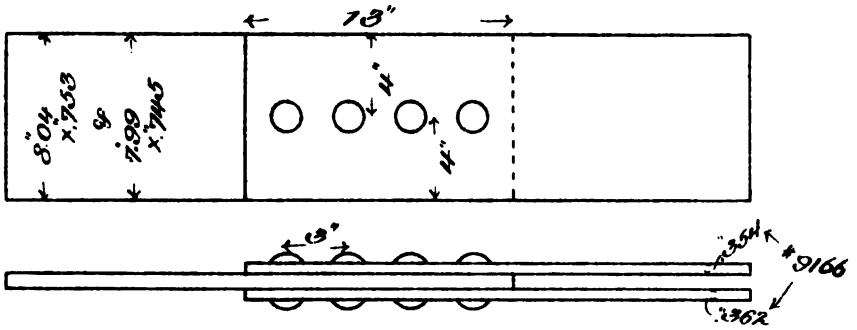
Fractured covers through outside rivet holes. Granular.

Maximum stress on joint.

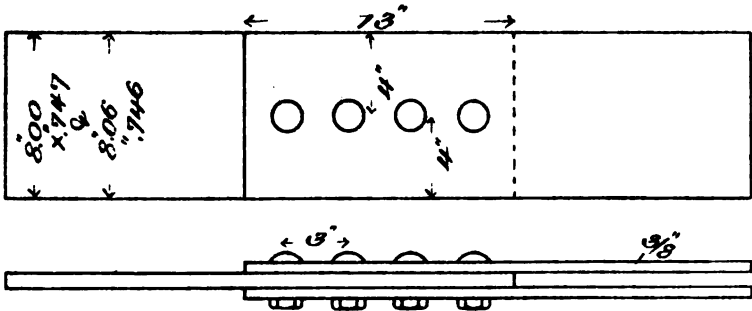
Tension on gross section of plate pounds per square inch.. 28,970

Tension on net section of covers do.... 34,040

Nos. 9166 ⁹⁴ 9167.



Nos. 9168 ⁹⁴ 9169.





No. 9167.

Marks, B 22.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " iron rivets.

Punched holes; punch $\frac{1}{2}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $7'' \cdot 99 \times '' \cdot 745 = 5.952$ square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	Initial load.
1,000		.0000		
2,000		.0000		
3,000		.0000		
4,000		.0000		
5,000		.0001		
6,000		.0001		
7,000		.0001		
8,000		.0001		
9,000		.0002		
10,000		.0002		
12,000		.0002		
14,000		.0003		
16,000		.0004		
18,000		.0006		
20,000		.0008		
24,000		.0009		
28,000		.0011		
32,000		.0013		
36,000		.0016		
40,000		.0018		
44,000		.0021		
48,000		.0037		
52,000		.0042		
56,000		.0052		
60,000		.0081		
64,000		.0088		
68,000		.0092		
72,000		.0099		
76,000		.0107		
80,000		.0210		
84,000		.0210		
88,000		.0222		
92,000		.0233		
96,000		.0249		
100,000		.0270		
104,000		.0318		
108,000		.0350		
112,000		.0375		
116,000		.0406		
120,000		.0440		
124,000		.0482		
128,000		.0528		
132,000		.0577		
169,480	28,470			Tensile strength.

Sheared the rivets. Started crack in one hole in cover.

No. 9168.

Marks, B 23.

$\frac{3}{4}$ " steel plate, $\frac{3}{4}$ " steel bolts.

Punched holes; punch $\frac{1}{8}$ " die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $8'' \times .747''$square inches.. 5.976

Shearing area of bolts, $.73$ diameterdo..... 3.348

Applied loads.		In ganged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.	0.	Initial load.
1,000		.0000		
2,000		.0000		
3,000		.0001		
4,000		.0001		
5,000		.0001		
6,000		.0002		
7,000		.0004		
8,000		.0005		
9,000		.0006		
10,000		.0008		
12,000		.0012		
13,000		.0298		
14,000		.0327		
16,000		.0372		
18,000		.0435		
20,000		.0481		
24,000		.0518		
28,000		.0689		
32,000		.0727		
36,000		.0800		
40,000		.0870		
44,000		.0942		
48,000		.1039		
52,000		.1120		
56,000		.1200		
60,000		.1280		
64,000		.1318		
68,000		.1381		
72,000		.1440		
76,000		.1500		
80,000		.1573		
140,100	{ 23,440			Tensile strength. Shearing strength of bolts.
	41,340			

Sheared the bolts.

No. 9169.

Marks, B 24.

$\frac{3}{8}$ " steel plate, $\frac{3}{4}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{7}{8}$ " diameter.

Gross sectional area of web plate, $8''.06 \times .716$square inches.. 6.013

Shearing area of bolts, $.73$ diameter.....do..... 3.348

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500		0.	0.	
1,000		.0005		
2,000		.0000		
3,000		.0000		
4,000		.0000		
5,000		.0001		
6,000		.0001		
7,000		.0003		
8,000		.0004		
9,000		.0005		
10,000		.0008		
12,000		.0008		
14,000		.0010		
15,000		.0014		
16,000		.0020		
17,000		.0042		
18,000		.0059		
20,000		.0083		
24,000		.0201		
28,000		.0328		
32,000		.0453		
36,000		.0811		
40,000		.0729		
44,000		.0819		
48,000		.0912		
52,000		.0991		
56,000		.1050		
60,000		.1131		
64,000		.1180		
68,000		.1258		
72,000		.1315		
76,000		.1400		
80,000		.1475		
114,200	{ 18,990			Tensile strength.
	{ 34,110			Shearing strength of bolts.

Sheared the bolts.

No. 9380.

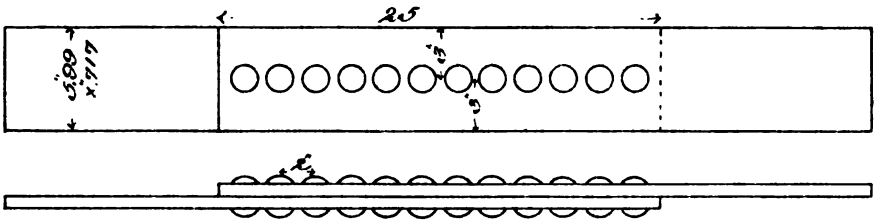
Marks, T 3.

 $\frac{3}{4}$ " steel plate, $\frac{5}{8}$ " iron rivets.Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ diameter.Gross sectional area of plate, $5'' \times .99 = 4.95$ square inches.

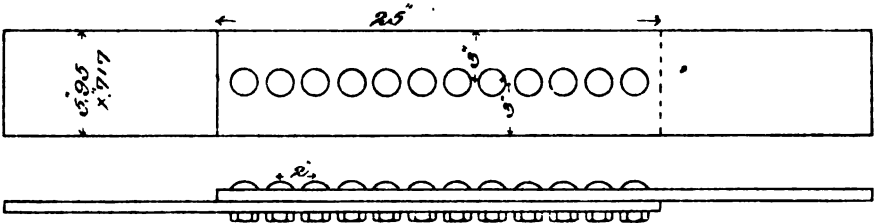
Gauged length, 26''.

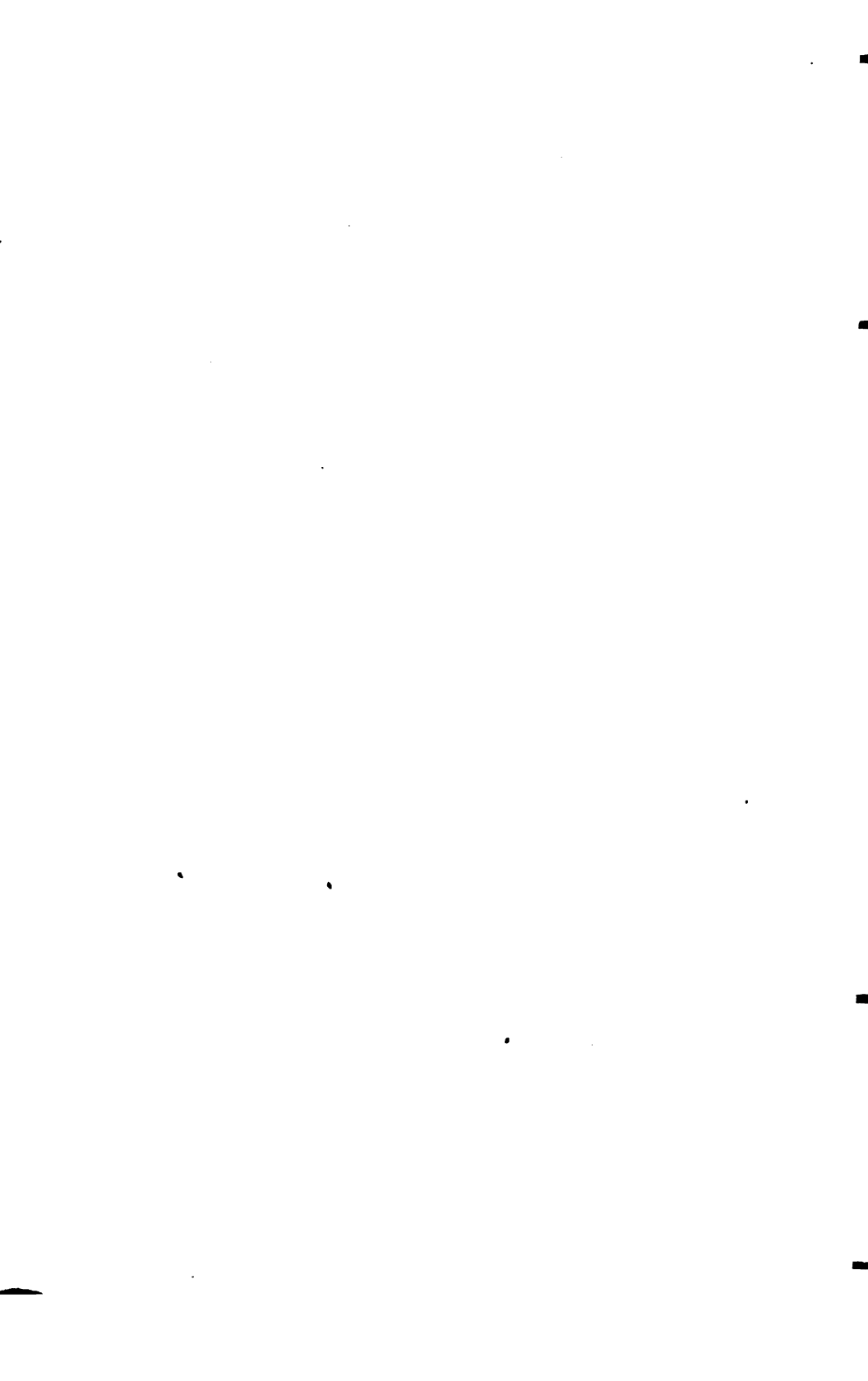
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	set.	
Pounds.	Pounds.	Inch.	Inch.	
500	0.	0.	Initial load.
1,0000003	.....
1,5000002	.....
2,0000003	.....
2,5000003	.....
3,0000004	.....
4,0000005	.....
5,0000006	.....
6,0000007	.....
7,0000009	.....
8,0000010	.....
9,0000011	.....
10,0000013	.....
11,0000014	.....
12,0000015	.....
13,0000017	.....
14,0000019	.....
15,0000020	.....
16,0000022	.....
17,0000024	.....
18,0000025	.....
19,0000028	.....
20,0000028	.0002	
21,0000030	.....
22,0000031	.....
23,0000033	.....
24,0000034	.....
25,0000035	.....
26,0000038	.....
27,0000039	.....
28,0000040	.....
29,0000042	.....
30,0000044	.0003	
31,0000045	.....
32,0000046	.....
33,0000048	.....
34,0000049	.....
35,0000050	.....
36,0000052	.....
37,0000054	.....
38,0000056	.....
39,0000058	.....
40,0000060	.0003	
41,0000062	.....
42,0000064	.....
43,0000066	.....
44,0000068	.....
45,0000070	.....
46,0000072	.....
47,0000074	.....
48,0000076	.....
49,0000078	.....
50,0000079	.0004	
51,0000080	.....
52,0000082	.....
53,0000084	.....
54,0000086	.....
55,0000088	.....
56,0000090	.....
57,0000091	.....
58,0000093	.....
59,0000095	.....
60,0000097	.0005	
61,0000100	.....
62,0000102	.....
63,0000105	.....

№. 9380.



№. 9381





No. 9330—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
64,000		.0107		
65,000		.0109		
66,000		.0111		
67,000		.0113		
68,000		.0115		
69,000		.0117		
70,000		.0119	.0009	
71,000		.0121		
72,000		.0124		
73,000		.0126		
74,000		.0128		
75,000		.0130		
76,000		.0132		
77,000		.0135		
78,000		.0138		
79,000		.0140		
80,000		.0144	.0020	
81,000		.0150		
82,000		.0155		
83,000		.0157		
84,000		.0160		
85,000		.0163		
86,000		.0166		
87,000		.0170		
88,000		.0173		
89,000		.0178		
90,000		.0185	.0042	
91,000		.0189		
92,000		.0200	.0113	
93,000		.0202		
94,000		.0205		
95,000		.0270		
96,000		.0274		
97,000		.0280		
98,000		.0284		
99,000		.0289		
100,000		.0301	.0141	
120,000		.04		
123,000				Scale started off plate.
130,000		.06		
140,000		.13		
150,000		.21		
160,000		.30		
169,900	39,600			Tensile strength.

Sheared the rivets. Started a fracture at sides of first hole in the plate.

No. 9381.

Marks, T 4.

$\frac{3}{4}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $5''.95 \times '.717$square inches.. 4.27

Shearing area of bolts, $'.61$ diameter.....do..... 3.50

Gauged length, 26".

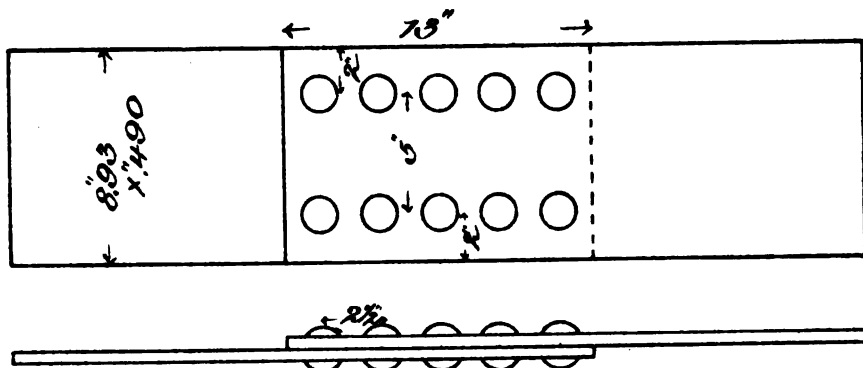
Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
500		0.	0.	Initial load.	
1,000		.0001			
1,500		.0002			
2,000		.0003			
2,500		.0004			
3,000		.0005			
4,000		.0006			
5,000		.0007			
6,000		.0008			
7,000		.0009			
8,000		.0010			
9,000		.0012			
10,000		.0014			
11,000		.0015			
12,000		.0017			
13,000		.0019			
14,000		.0021			
15,000		.0023			
16,000		.0025			
17,000		.0027			
18,000		.0028			
19,000		.0030			
20,000		.0032	.0003		
21,000		.0034			
22,000		.0036			
23,000		.0038			
24,000		.0040			
25,000		.0044			
26,000		.0046			
27,000		.0048			
28,000		.0051			
29,000		.0054			
30,000		.0057	.0009		
31,000		.0070			
32,000		.0081			
33,000		.0107			
34,000		.0140			
35,000		.0300			
37,000		.03			
38,000		.05			
39,000		.05+			
40,000		.07			
44,000		.08			
48,000		.10			
50,000		.11			
54,000		.12			
58,000		.12+			
60,000		.13			
64,000		.13+			
68,000		.15			
72,000		.16			
76,000		.17			
80,000		.18			
84,000		.18+			
88,000		.19			
92,000		.20			
96,000		.21			
100,000		.22			
110,000		.24			
113,100	{ 26,490				Tensile strength.
	{ 32,310				Shearing strength of bolts.

Sheared the bolts.

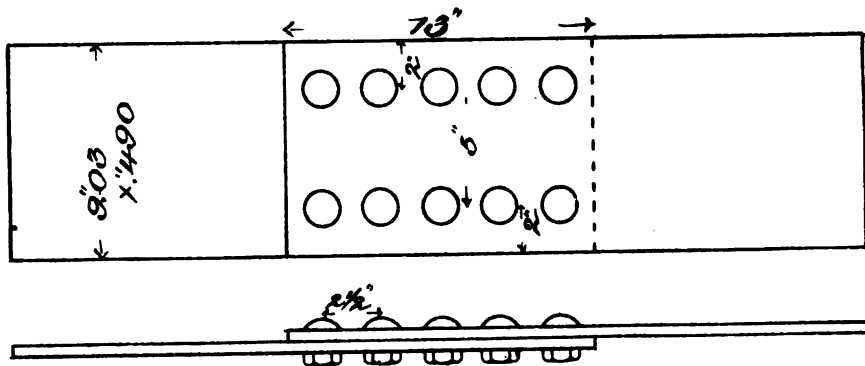
A number of the bolts had their threads cut beyond the shearing plane.



No. 9382.



No. 9383.



No. 9382.

Marks, T 21.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $1\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $8'' \times .93 \times '' .490$ square inches... 4.38

Net sectional area of plate, $7'' \times .49 \times '' .490$ do..... 3.67

Gauged length, 15''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.		Initialload.
1,000		.0001		
1,500		.0001		
2,000		.0001		
2,500		.0002		
3,000		.0002		
4,000		.0003		
5,000		.0005		
6,000		.0006		
7,000		.0007		
8,000		.0007		
9,000		.0009		
10,000		.0010		
11,000		.0011		
12,000		.0012		
13,000		.0013		
14,000		.0014		
15,000		.0015		
16,000		.0016		
17,000		.0016		
18,000		.0017		
19,000		.0019		
20,000		.0020	0.	
21,000		.0021		
22,000		.0022		
23,000		.0023		
24,000		.0025		
25,000		.0026		
26,000		.0027		
27,000		.0028		
28,000		.0030		
29,000		.0031		
30,000		.0032	0.	
31,000		.0033		
32,000		.0034		
33,000		.0036		
34,000		.0037		
35,000		.0038		
36,000		.0039		
37,000		.0040		
38,000		.0042		
39,000		.0043		
40,000		.0045	.0001	
41,000		.0046		
42,000		.0047		
43,000		.0048		
44,000		.0050		
45,000		.0051		
46,000		.0053		
47,000		.0054		
48,000		.0056		
49,000		.0057		
50,000		.0058	.0001	
51,000		.0060		
52,000		.0062		
53,000		.0063		
54,000		.0064		
55,000		.0066		
56,000		.0067		
57,000		.0069		
58,000		.0070		
59,000		.0072		
60,000		.0074	.0005	
61,000		.0076		
62,000		.0078		

No. 9382—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
63,000		.0080		
64,000		.0082		
65,000		.0084		
66,000		.0085		
67,000		.0086		
68,000		.0089		
69,000		.0091		
70,000		.0093	.0011	
71,000		.0096		
72,000		.0101		
73,000		.0104		
74,000		.0106		
75,000		.0112		
76,000		.0116		
77,000		.0120		
78,000		.0124		
79,000		.0127		
80,000		.0132	.0085	
81,000		.0141		
82,000		.0146		
83,000		.0150		
84,000		.0156		
85,000		.0161		
86,000		.0166		
87,000		.0171		
88,000		.0175		
89,000		.0176		
90,000		.0181	.0071	
91,000		.0187		
92,000		.0192		
93,000		.0194		
94,000		.0196		
95,000		.0200		
96,000		.0202		
97,000		.0205		
98,000		.0208		
99,000		.0211		
100,000		.0215	.0091	
101,000		.0221		
102,000		.0224		
103,000		.0226		
104,000		.0229		
105,000		.0232		
106,000		.0237		
107,000		.0242		
108,000		.0246		
109,000		.0249		
110,000		.0256	.0111	
111,000		.0270		
112,000		.0272		
113,000		.0276		
114,000		.0281		
115,000		.0288		
116,000		.0294		
117,000		.0330		
120,000		.04		
130,000		.06		
140,000		.07		
150,000		.12		
157,400	35,940			

Tensile strength.

Fractured plate across first row of rivet holes. Granular.

Maximum stress on joint.

Tension on gross section of plate.....pounds per square inch.. 35,940
 Tension on net section of plate.....do..... 42,890

No. 9383.

Marks, T 22.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $9''.03 \times ''490$square inches.. 4.42

Shearing area of bolts, $''61$ diameter.....do.... 2.92

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	Initial load.
1,000		.0001		
1,500		.0001		
2,000		.0002		
2,500		.0002		
3,000		.0003		
4,000		.0003		
5,000		.0004		
6,000		.0005		
7,000		.0006		
8,000		.0007		
9,000		.0008		
10,000		.0009		
11,000		.0010		
12,000		.0011		
13,000		.0012		
14,000		.0014		
15,000		.0016		
16,000		.0017		
17,000		.0018		
18,000		.0019		
19,000		.0020	.0002	
20,000		.0022		
21,000		.0024		
22,000		.0025		
23,000		.0026		
24,000		.0028		
25,000		.0030		
26,000		.0033		
27,000		.0036		
28,000		.0041		
29,000		.06		
30,000		.06		
32,000		.07		
36,000		.08		
40,000		.09		
44,000		.10		
48,000		.11		
50,000		.11+		
54,000		.12		
58,000		.13		
60,000		.13+		
64,000		.15		
68,000		.16		
72,000		.17		
76,000		.18		
80,000		.20		
84,000	{ 19,000	.23		Tensile strength.
	{ 28,770			Shearing strength of bolts.

Sheared the bolts.

Bolts in part found in loose condition. They were all set up before testing, using a wrench of 14" leverage.

No. 9384.

Marks, T 13.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

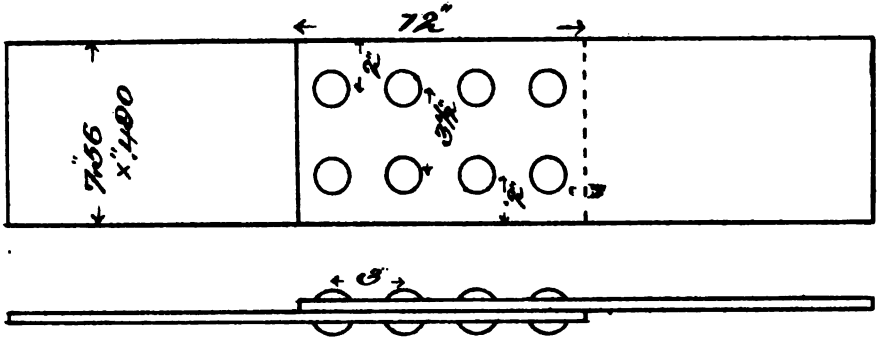
Gross sectional area of plate, $7''.56 \times '' .490$square inches.. 3.70

Net sectional area of plate, $6''.12 \times '' .490$do.... 3.00

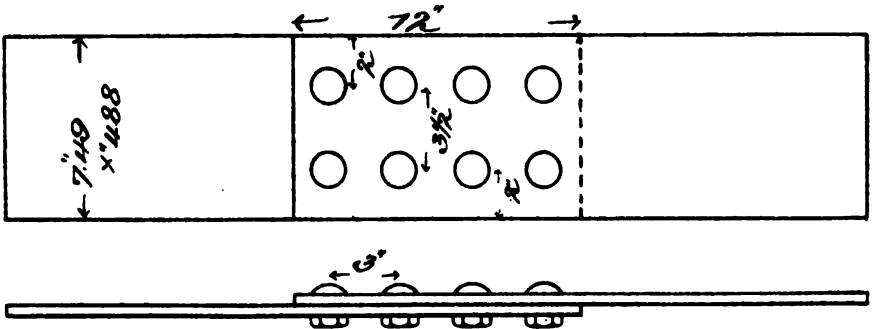
Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	Initial load.
1,000		.0001		
1,500		.0001		
2,000		.0001		
2,500		.0002		
3,000		.0003		
4,000		.0004		
5,000		.0005		
6,000		.0006		
7,000		.0008		
8,000		.0009		
9,000		.0011		
10,000		.0012		
11,000		.0014		
12,000		.0015		
13,000		.0016		
14,000		.0017		
15,000		.0018		
16,000		.0020		
17,000		.0021		
18,000		.0022		
19,000		.0023		
20,000		.0024	.0001	
21,000		.0025		
22,000		.0026		
23,000		.0028		
24,000		.0029		
25,000		.0030		
26,000		.0031		
27,000		.0033		
28,000		.0034		
29,000		.0036		
30,000		.0036	.0001	
31,000		.0038		
32,000		.0040		
33,000		.0041		
34,000		.0042		
35,000		.0044		
36,000		.0045		
37,000		.0046		
38,000		.0048		
39,000		.0050		
40,000		.0051	.0001	
41,000		.0053		
42,000		.0055		
43,000		.0056		
44,000		.0058		
45,000		.0060		
46,000		.0061		
47,000		.0063		
48,000		.0065		
49,000		.0066		
50,000		.0067	.0004	
51,000		.0070		
52,000		.0072		
53,000		.0074		
54,000		.0076		
55,000		.0078		
56,000		.0080		
57,000		.0082		
58,000		.0085		
59,000		.0087		
60,000		.0090	.0012	
61,000		.0094		
62,000		.0096		

No. 9384.



No. 9385.



QUESTION

1. The following table shows the number of people who were employed in the manufacturing sector in the United Kingdom from 1970 to 2000. The number of people employed in the manufacturing sector in 1970 was 4,000,000. The number of people employed in the manufacturing sector in 2000 was 2,000,000.

2. The following table shows the number of people who were employed in the manufacturing sector in the United Kingdom from 1970 to 2000. The number of people employed in the manufacturing sector in 1970 was 4,000,000. The number of people employed in the manufacturing sector in 2000 was 2,000,000.

3. The following table shows the number of people who were employed in the manufacturing sector in the United Kingdom from 1970 to 2000. The number of people employed in the manufacturing sector in 1970 was 4,000,000. The number of people employed in the manufacturing sector in 2000 was 2,000,000.

4. The following table shows the number of people who were employed in the manufacturing sector in the United Kingdom from 1970 to 2000. The number of people employed in the manufacturing sector in 1970 was 4,000,000. The number of people employed in the manufacturing sector in 2000 was 2,000,000.

5. The following table shows the number of people who were employed in the manufacturing sector in the United Kingdom from 1970 to 2000. The number of people employed in the manufacturing sector in 1970 was 4,000,000. The number of people employed in the manufacturing sector in 2000 was 2,000,000.

6. The following table shows the number of people who were employed in the manufacturing sector in the United Kingdom from 1970 to 2000. The number of people employed in the manufacturing sector in 1970 was 4,000,000. The number of people employed in the manufacturing sector in 2000 was 2,000,000.

7. The following table shows the number of people who were employed in the manufacturing sector in the United Kingdom from 1970 to 2000. The number of people employed in the manufacturing sector in 1970 was 4,000,000. The number of people employed in the manufacturing sector in 2000 was 2,000,000.

No. 9384—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
63,0000100	.....
64,0000105	.....
65,0000111	.....
66,0000115	.....
67,0000120	.....
68,0000125	.....
69,0000180	.....
70,0000134	.0040	
71,0000142	.....
72,0000145	.....
73,0000145	.....
74,0000151	.....
75,0000155	.....
76,0000159	.....
77,0000162	.....
78,0000166	.....
79,0000170	.....
80,0000174	.0061	
81,0000180	.....
82,0000183	.....
83,0000186	.....
84,0000190	.....
85,0000193	.....
86,0000196	.....
87,0000201	.....
88,0000205	.....
89,0000210	.....
90,0000215	.0062	
91,0000225	.....
92,0000232	.....
93,0000241	.....
94,0000249	.....
95,00003	.....
98,00003+	.....
100,00003+	.....
110,00004	.....
120,00008	.....
127,100	34,350	.....	.....	Tensile strength.

Fractured plate across first row of rivet holes. Granular.

Maximum stress on joint.

Tension on gross section of plate.....pounds per square inch.. 34,350
 Tension on net section of platedo.... 42,370

No. 9385.

Marks, T 14.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

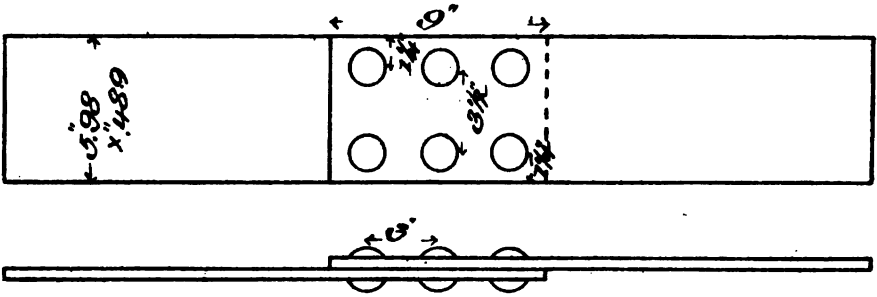
Gross sectional area of plate, $7''.49 \times '' .488$ square inches.. 3.65

Shearing area of bolts, $\frac{1}{2}$ " diameter..... do..... 2.34

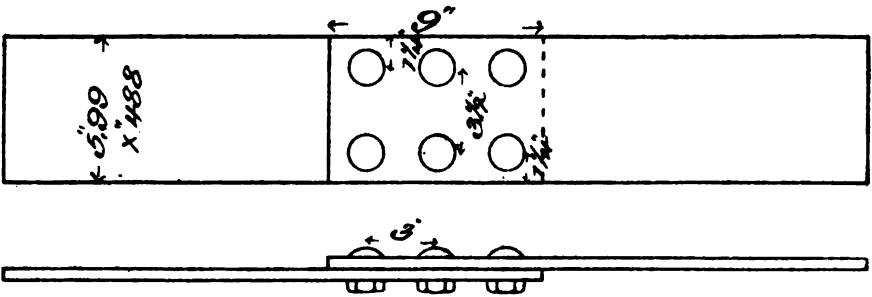
Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	0.	0.	Initial load.
1,0000001	.....
1,5000001	.....
2,0000002	.....
2,5000002	.....
3,0000003	.....
4,0000004	.....
5,0000006	.....
6,0000007	.....
7,0000008	.....
8,0000009	.....
9,0000010	.....
10,0000011	.....
11,0000012	.....
12,0000014	.....
13,0000016	.....
14,0000017	.....
15,0000019	.....
16,0000020	.....
17,0000021	.....
18,0000023	.....
19,0000025	.....
20,0000027	.0003	
21,0000029	.....
22,0000031	.....
23,0000033	.....
24,0000035	.....
25,0000040	.....
26,0000051	.....
27,00003	.....
30,00014	.....
36,00016	.....
40,00017	.....
44,00017+	.....
48,00017+	.....
54,00019	.....
58,00020	.....
64,00022	.....
68,00028	.....
72,00024	.....
76,00026	.....
80,00027	.....
81,800	{ 22,410	Tensile strength.
	34,960	Shearing strength of bolts.

Sheared the bolts.

No. 9386.



No. 9387.



No. 9386.

Marks, T 5.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $5''.98 \times ".489 = 2.92$ square inches.

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500	0.	0.	Initial load.
1,0000002	.....
1,5000003	.....
2,0000004	.....
2,5000004	.....
3,0000005	.....
4,0000006	.....
5,0000008	.....
6,0000010	.....
7,0000011	.....
8,0000012	.....
9,0000014	.....
10,0000015	.....
11,0000018	.....
12,0000019	.....
13,0000021	.....
14,0000024	.....
15,0000028	.....
16,0000028	.....
17,0000030	.....
18,0000032	.....
19,0000033	.....
20,0000034	0.	
21,0000036	.....
22,0000039	.....
23,0000040	.....
24,0000042	.....
25,0000044	.....
26,0000047	.....
27,0000049	.....
28,0000051	.....
29,0000054	.....
30,0000055	.0002	
31,0000057	.....
32,0000059	.....
33,0000061	.....
34,0000063	.....
35,0000065	.....
36,0000067	.....
37,0000070	.....
38,0000072	.....
39,0000075	.....
40,0000077	.0003	
41,0000083	.....
42,0000085	.....
43,0000087	.....
44,0000089	.....
45,0000091	.....
46,0000094	.....
47,0000096	.....
48,0000099	.....
49,0000101	.....
50,0000104	.0005	
51,0000108	.....
52,0000113	.....
53,0000115	.....
54,0000119	.....
55,0000125	.....
56,0000133	.....
57,0000139	.....
58,0000145	.....
59,0000154	.....
60,0000163	.0045	
61,0000164	Rested 16 hours.
62,0000166	.....
63,0000171	.....
64,0000189	.....

No. 9386—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
65,000		.0202		
66,000		.0211		
67,000		.0220		
68,000		.0227		
69,000		.0237		
70,000		.0247	.0111	
71,000		.0264		
72,000		.0269		
73,000		.0275		
74,000		.0286		
75,000		.0302		
80,000		.04		
84,000		.08		
92,000		.14		
96,000	32,880			

Tensile strength.

Sheared the rivets. Started a fracture at sides of rivet hole in first row.

No. 9387.

Marks, T 6.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $5'' \times .99 \times '' .488$square inches.. 2.92

Shearing area of bolts, $'' .61$ diameter.....do..... 1.75

Gauged length, 15''.

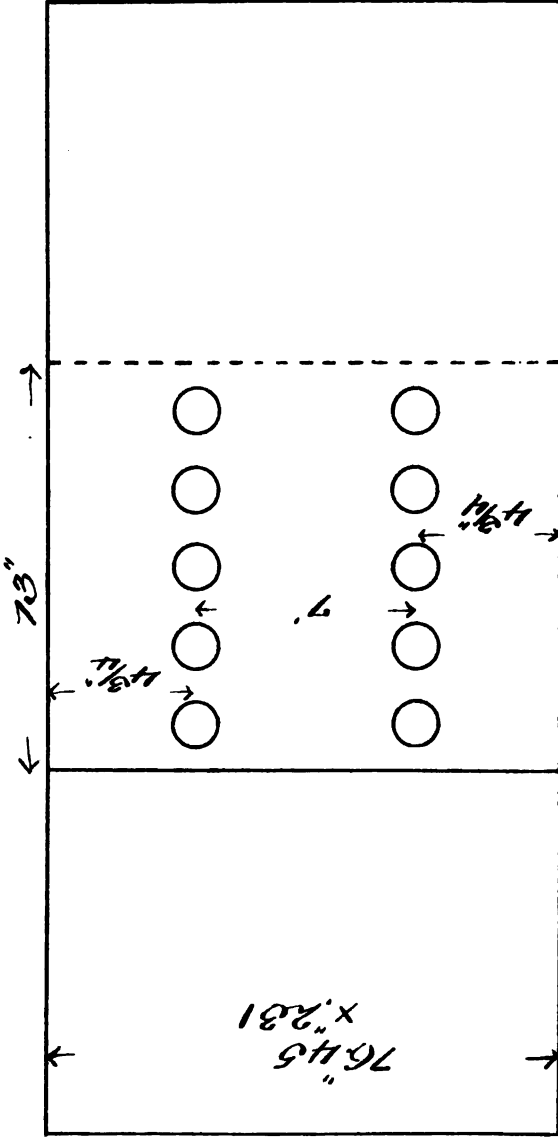
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	
1,000		.0001		
1,500		.0001		
2,000		.0003		
2,500		.0004		
3,000		.0005		
4,000		.0006		
5,000		.0008		
6,000		.0010		
7,000		.0012		
8,000		.0014		
9,000		.0016		
10,000		.0019		
11,000		.0021		
12,000		.0025		
13,000		.0029		
14,000		.0033		
15,000		.0039		
16,000		.0050		
17,000		.03		
22,000		.08		
26,000		.11		
30,000		.13		
34,000		.16		
38,000		.17		
42,000		.18		
44,000		.19		
48,000		.21		
51,800	17,740 29,600			

Tensile-strength.
Shearing strength of bolts.

Sheared the bolts.



No. 9388.



No. 9388.

Marks, T 25.

$\frac{1}{4}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $16'' \times .45 \times .231 = 3.80$ square inches.

Gauged length, 15''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500		0.	0.	
1,000		.0001		
1,500		.0003		
2,000		.0004		
2,500		.0005		
3,000		.0006		
4,000		.0008		
5,000		.0011		
6,000		.0013		
7,000		.0016		
8,000		.0019		
9,000		.0021		
10,000		.0024		
11,000		.0026		
12,000		.0029		
13,000		.0031		
14,000		.0033		
15,000		.0035		
16,000		.0038		
17,000		.0041		
18,000		.0044		
19,000		.0046		
20,000		.0048	.0004	
21,000		.0051		
22,000		.0054		
23,000		.0057		
24,000		.0059		
25,000		.0062		
26,000		.0065		
27,000		.0069		
28,000		.0072		
29,000		.0075		
30,000		.0079	.0015	
31,000		.0085		
32,000		.0089		
33,000		.0091		
34,000		.0094		
35,000		.0096		
36,000		.0101		
37,000		.0104		
38,000		.0108		
39,000		.0112		
40,000		.0115	.0033	
41,000		.0121		
42,000		.0124		
43,000		.0128		
44,000		.0131		
45,000		.0134		
46,000		.0137		
47,000		.0140		
48,000		.0143		
49,000		.0146		
50,000		.0149	.0049	
51,000		.0152		
52,000		.0155		
53,000		.0158		
54,000		.0161		
55,000		.0163		
56,000		.0166		
57,000		.0169		
58,000		.0171		
59,000		.0175		
60,000		.0177	.0062	
61,000		.0181		
62,000		.0184		
63,000		.0186		
64,000		.0189		

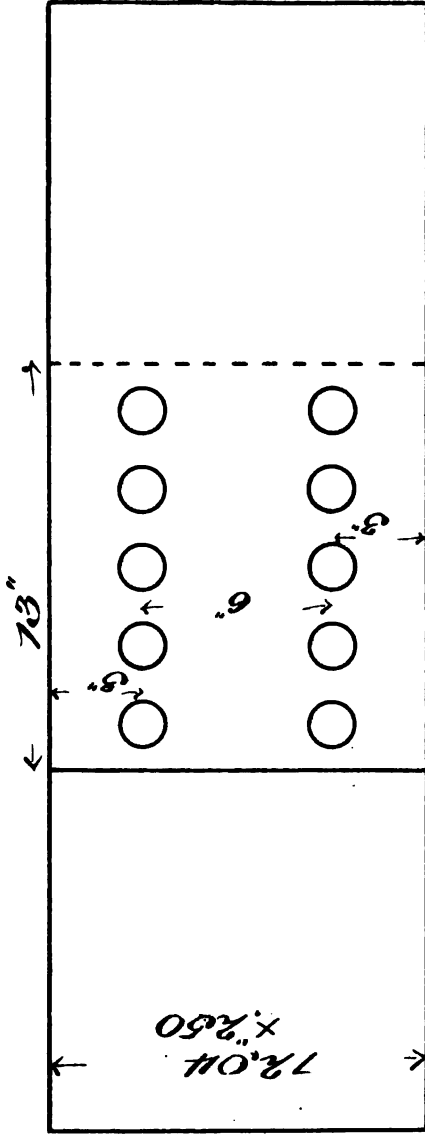
No. 9388—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
65,000		.0191		
66,000		.0194		
67,000		.0196		
68,000		.0200		
69,000		.0203		
70,000		.0205	.0072	
71,000		.0210		
72,000		.0212		
73,000		.0215		
74,000		.0216		
75,000		.0218		
76,000		.0221		
77,000		.0223		
78,000		.0226		
79,000		.0228		
80,000		.0230	.0079	
81,000		.0235		
82,000		.0239		
83,000		.0242		
84,000		.0244		
85,000		.0246		
86,000		.0250		
87,000		.0254		
88,000		.0257		
89,000		.0260		
90,000		.0264	.0092	
91,000		.0269		
92,000		.0271		
93,000		.0275		
94,000		.0277		
95,000		.0280		
96,000		.0283		
97,000		.0286		
98,000		.0290		
99,000		.0293		
100,000		.0295	.0104	
110,000		.03		
120,000		.04		
130,000		.06		
140,000		.07		
150,000		.11		
160,000		.22		
169,700	44,660			Tensile strength.

Sheared the rivets.



No. 9389.



No. 9389.

Marks, T 26.

$\frac{1}{4}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $12'' \times .04 \times .250$ square inches... 3.01

Shearing area of bolts, $\frac{1}{4}$ " diameter do.... 2.92

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	0.	0.	
1,0000001	.....
1,5000002	.....
2,0000003	.....
2,5000005	.....
3,0000006	.....
4,0000009	.....
5,0000012	.....
6,0000015	.....
7,0000017	.....
8,0000021	.....
9,0000023	.....
10,0000027	.....
11,0000031	.....
12,0000040	.....
13,0000048	.....
14,0000056	.....
15,0000065	.....
16,0000076	.....
17,0000085	.....
18,0000095	.....
19,0000109	.....
20,0000126	.0089	
21,0000150	.....
22,0000171	.....
23,0000197	.....
24,0000235	.....
25,0000275	.....
26,00003	.....
30,00005	.....
34,00006	.....
38,00008	.....
38,00009	.....
42,00010	After hammering lightly with a 2½-pound hammer.
46,00010	.....
50,00011	.....
54,00012	.....
58,00013	.....
62,00013+	.....
66,00015	.....
70,00015+	.....
74,00016	.....
78,00016+	.....
82,00017	.....
86,00019	.....
90,00020	.....
94,00021	.....
100,00025	.....
105,200	{ 34,950	Tensile strength.
	{ 36,030	Shearing strength of bolts.

Sheared the bolts.

No. 9390.

Marks, T 17.

$\frac{1}{4}$ " steel plate, $\frac{5}{8}$ " iron rivets.

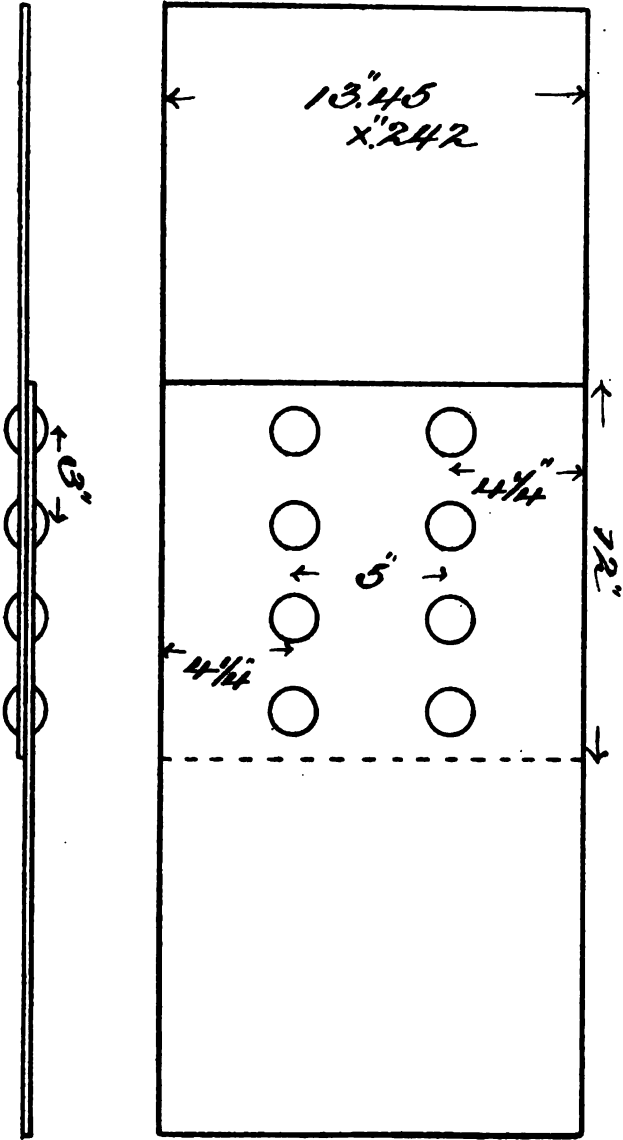
Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $13'' \cdot 45 \times '' \cdot 242 = 3.25$ square inches.

Gauged length, 15".

Applied loads.		In. gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.	0.	Initial load.
1,000		.0001		
1,500		.0002		
2,000		.0003		
2,500		.0004		
3,000		.0005		
4,000		.0006		
5,000		.0007		
6,000		.0008		
7,000		.0009		
8,000		.0010		
9,000		.0012		
10,000		.0014		
11,000		.0016		
12,000		.0018		
13,000		.0020		
14,000		.0021		
15,000		.0024		
16,000		.0025		
17,000		.0028		
18,000		.0030		
19,000		.0031		
20,000		.0034	0.	
21,000		.0036		
22,000		.0037		
23,000		.0039		
24,000		.0041		
25,000		.0043		
26,000		.0046		
27,000		.0048		
28,000		.0050		
29,000		.0052		
30,000		.0055	.0005	
31,000		.0058		
32,000		.0061		
33,000		.0063		
34,000		.0066		
35,000		.0069		
36,000		.0071		
37,000		.0074		
38,000		.0076		
39,000		.0079		
40,000		.0082	.0016	
41,000		.0086		
42,000		.0088		
43,000		.0090		
44,000		.0093		
45,000		.0096		
46,000		.0098		
47,000		.0102		
48,000		.0106		
49,000		.0109		
50,000		.0111	.0024	
51,000		.0116		
52,000		.0119		
53,000		.0121		
54,000		.0124		
55,000		.0128		
56,000		.0130		
57,000		.0133		
58,000		.0136		
59,000		.0139		
60,000		.0142	.0039	
61,000		.0149		
62,000		.0152		
63,000		.0154		

No. 9390.





No. 9390—Continued.

Applied loads.		In ganged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
64,0000157	.....
65,0000160	.....
66,0000163	.....
67,0000166	.....
68,0000169	.....
69,0000172	.....
70,0000175	.0049	
71,0000181	.....
72,0000184	.....
73,0000187	.....
74,0000190	.....
75,0000193	.....
76,0000196	.....
77,0000199	.....
78,0000202	.....
79,0000204	.....
80,0000208	.0080	
81,0000212	.....
82,0000215	.....
83,0000220	.....
84,0000225	.....
85,0000229	.....
86,0000236	.....
87,0000243	.....
88,0000249	.....
89,0000255	.....
90,0000268	.0124	
91,0000280	.....
92,0000310	.....
94,00003+	.....
100,00004	.....
110,00006	.....
120,00008	.....
130,00011	.....
138,800	42,710	.....	.....	Tensile strength.

Sheared the rivets.

No. 9391.

Marks, T 18.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $9''.99 \times '' .250$square inches.. 2.50

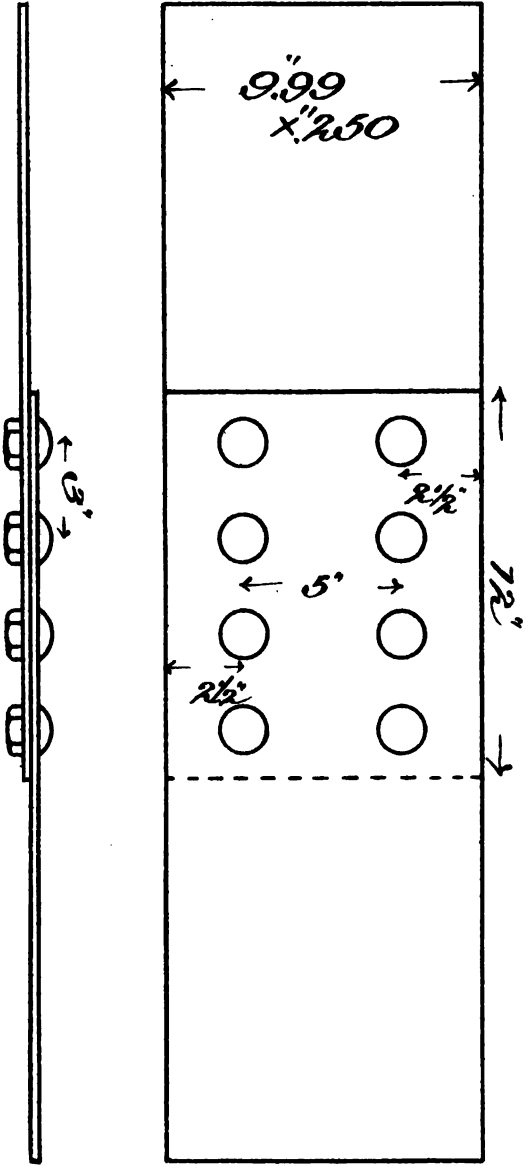
Shearing area of bolts, $'' .61$ diameter.....do..... 2.34

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
		0.	0.	
500				
1,000		.0001		
1,500		.0002		
2,000		.0003		
2,500		.0004		
3,000		.0005		
4,000		.0006		
5,000		.0007		
6,000		.0009		
7,000		.0011		
8,000		.0013		
9,000		.0015		
10,000		.0017		
11,000		.0019		
12,000		.0021		
13,000		.0024		
14,000		.0026		
15,000		.0028		
16,000		.0030		
17,000		.0034		
18,000		.0036		
19,000		.0040		
20,000		.0048	.0011	
21,000		.11		
24,000		.12		
28,000		.14		
32,000		.15		
36,000		.16		
40,000		.17		
44,000		.17		
48,000		.18		
52,000		.19		
56,000		.20		
60,000		.21		
64,000		.22		
68,000		.23		
72,000		.25		
76,000		.26		
80,000		.28		
84,000		.30		
87,100	{ 34,840			Tensile strength.
	{ 37,220			Shearing strength of bolts.

Sheared the bolts.

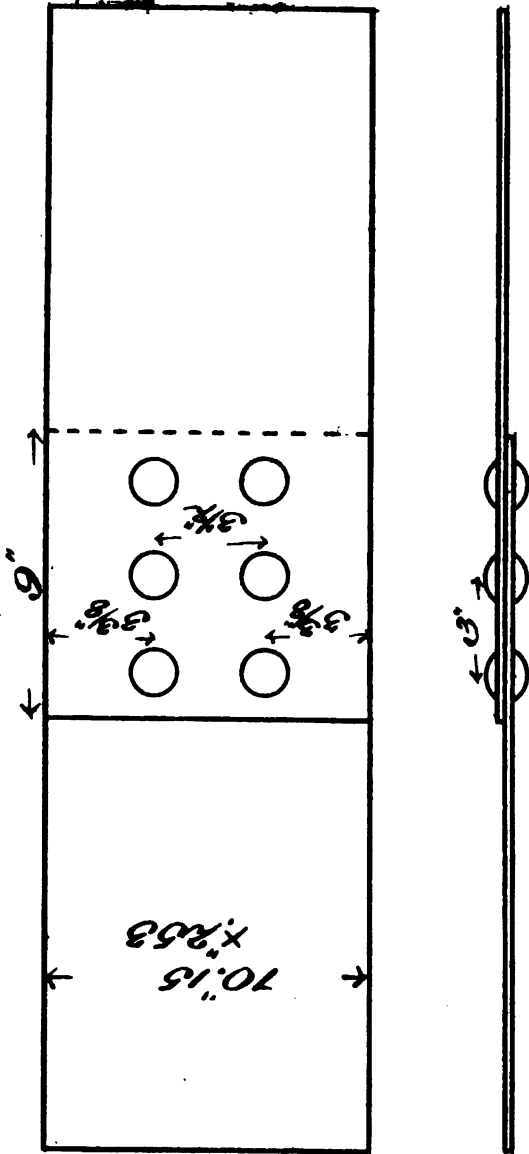
No. 9391.





THE
MIDDLE
CLASS
IN
THE
NINETEENTH
CENTURY

No. 9392.



No. 9392.

Marks, T 9.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $10'' \times .15 \times .253 = 2.57$ square inches.

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.	0.	Initial load.
1,000		.0001		
1,500		.0003		
2,000		.0003		
2,500		.0005		
3,000		.0006		
4,000		.0008		
5,000		.0010		
6,000		.0013		
7,000		.0015		
8,000		.0017		
9,000		.0020		
10,000		.0023		
11,000		.0026		
12,000		.0029		
13,000		.0032		
14,000		.0034		
15,000		.0037		
16,000		.0040		
17,000		.0042		
18,000		.0045		
19,000		.0048		
20,000		.0050	.0007	
21,000		.0053		
22,000		.0056		
23,000		.0060		
24,000		.0064		
25,000		.0067		
26,000		.0071		
27,000		.0075		
28,000		.0079		
29,000		.0083		
30,000		.0088	.0022	
31,000		.0093		
32,000		.0097		
33,000		.0102		
34,000		.0106		
35,000		.0112		
36,000		.0117		
37,000		.0121		
38,000		.0126		
39,000		.0131		
40,000		.0135	.0046	
41,000		.0142		
42,000		.0146		
43,000		.0150		
44,000		.0155		
45,000		.0160		
46,000		.0163		
47,000		.0168		
48,000		.0172		
49,000		.0177		
50,000		.0182		
51,000		.0189		
52,000		.0193		
53,000		.0197		
54,000		.0201		
55,000		.0206		
56,000		.0210		
57,000		.0215		
58,000		.0217		
59,000		.0223		
60,000		.0227		
61,000		.0236		
62,000		.0240		
63,000		.0244		
64,000		.0249		

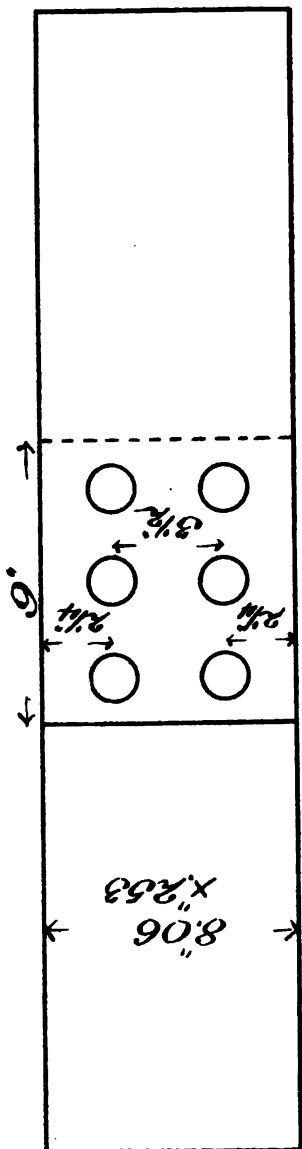
No. 9392—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
65,000		.0255		
66,000		.0262		
67,000		.0268		
68,000		.0273		
69,000		.0281		
70,000		.0289	.0128	
72,000		.03		
76,000		.04		
80,000		.06		
84,000		.07		
88,000		.08		
92,000		.10		
96,000		.17		
100,000		.87		
105,900	41,210			Tensile strength.

Sheared the rivets.

Fracture started at outside row of rivets in one plate, and at end of same plate in front of the inside row of rivets.

No. 9393.



No. 9393.

Marks, T 10.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $8 \times .06 \times .253$ square inches.. 2.04

Shearing area of bolts, $.61$ diameter do..... 1.75

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500	0.	0.	Initial load.
1,0000001	.....
1,5000003	.....
2,0000004	.....
2,5000005	.....
3,0000007	.....
4,0000009	.....
5,0000012	.....
6,0000015	.....
7,0000019	.....
8,0000022	.....
9,0000025	.....
10,0000028	.....
11,0000031	.....
12,0000034	.....
13,0000038	.....
14,0000042	.....
15,0000046	.....
16,0000052	.....
17,0000059	.....
18,0000066	.....
19,0000235	.....
20,0000304	.0256	
21,00003	.....
24,00004	.....
28,00005	.....
32,00006	.....
36,00009	.....
40,00010	.....
44,00011	.....
48,00012	.....
52,00014	.....
56,00016	.....
60,00017	.....
64,00021	.....
66,700	{ 32,700	Tensile strength.
	{ 38.110	Shearing strength of bolts.

Sheared the bolts.

H. Doc. 131—21

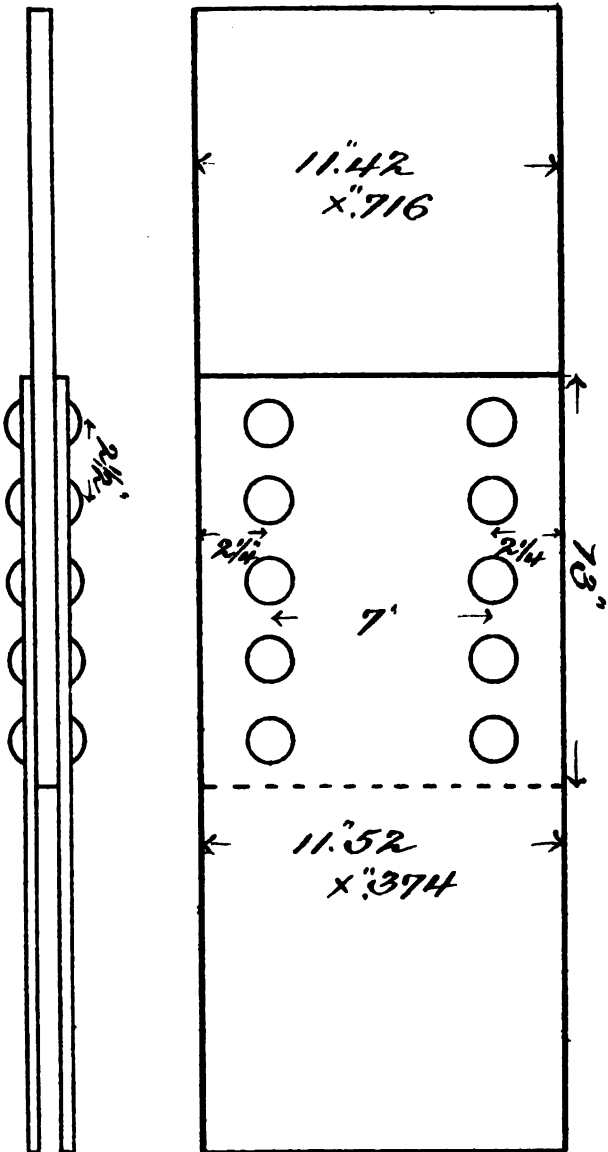
No. 9394.

Marks, T 23.

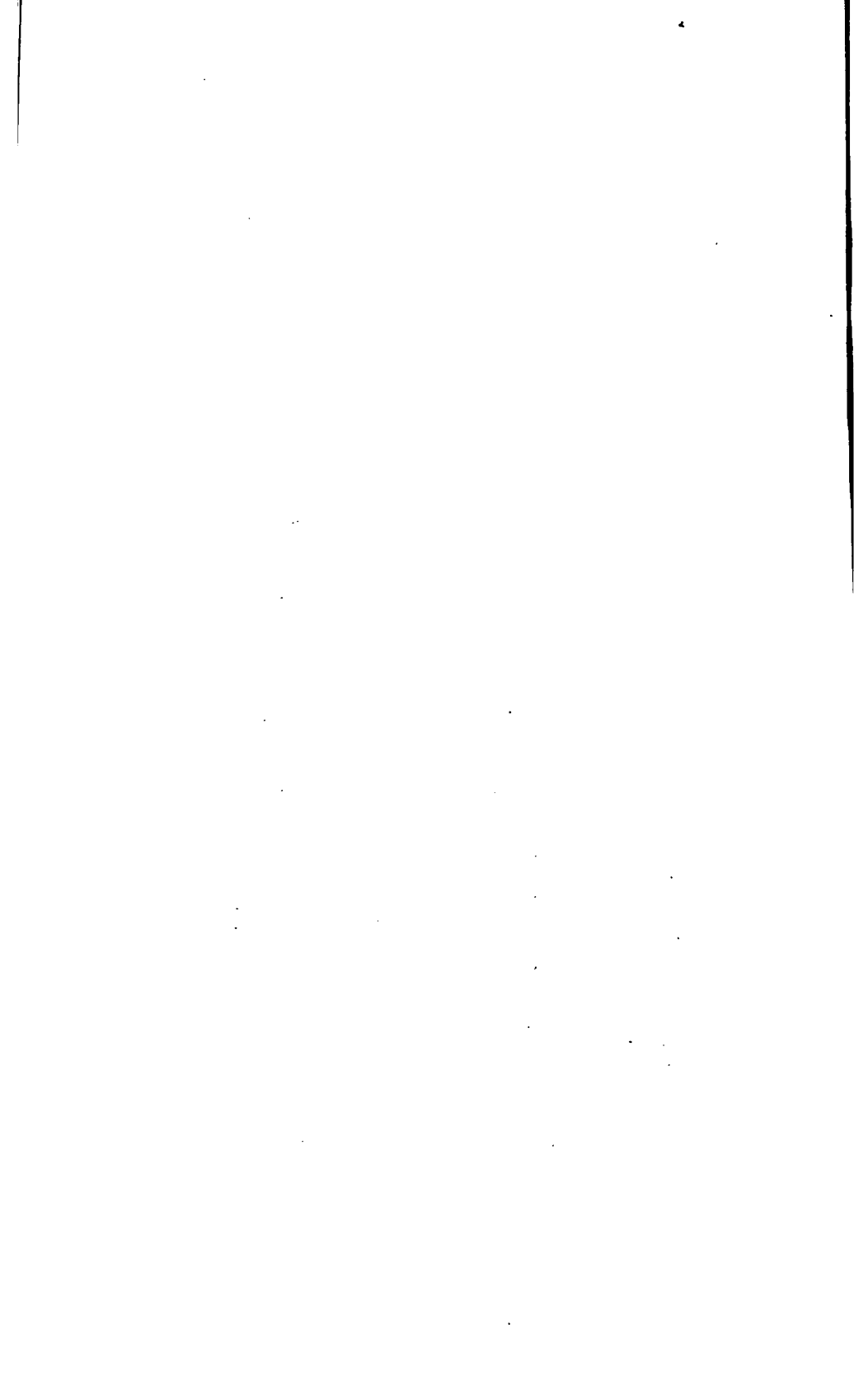
 $\frac{3}{4}$ " steel plate, $\frac{5}{8}$ " iron rivets.Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.Gross sectional area of web plate, $11''.42 \times .716 = 8.18$ square inches.

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.	0.	Initial load.
1,000		.0001		
2,000		.0002		
4,000		.0003		
6,000		.0004		
8,000		.0005		
10,000		.0006		
12,000		.0007		
14,000		.0009		
16,000		.0010		
18,000		.0011		
20,000		.0012		
22,000		.0012		
24,000		.0013		
26,000		.0013		
28,000		.0014		
30,000		.0015		
32,000		.0016		
34,000		.0017		
36,000		.0018		
38,000		.0019		
40,000		.0020	.0002	
42,000		.0022		
44,000		.0023		
46,000		.0024		
48,000		.0025		
50,000		.0026		
52,000		.0027		
54,000		.0028		
56,000		.0029		
58,000		.0030		
60,000		.0031	.0003	
62,000		.0032		
64,000		.0033		
66,000		.0034		
68,000		.0035		
70,000		.0036		
72,000		.0037		
74,000		.0039		
76,000		.0040		
78,000		.0041		
80,000		.0043	.0005	
82,000		.0044		
84,000		.0045		
86,000		.0047		
88,000		.0048		
90,000		.0049		
92,000		.0051		
94,000		.0052		
96,000		.0053		
98,000		.0055		
100,000		.0056	.0010	
102,000		.0058		
104,000		.0060		
106,000		.0062		
108,000		.0064		
110,000		.0066		
112,000		.0069		
114,000		.0071		
116,000		.0088		
118,000		.0100		
120,000		.0102	.0047	
122,000		.0105		
124,000		.0107		
126,000		.0109		
128,000		.0111		
130,000		.0112		



No. 9394.



No. 9394—Continued.

Applied loads.		In gaged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
132,0000120	.....
134,0000123	.....
136,0000128	.....
138,0000131	.....
140,0000134	.0066	
142,0000140	.....
144,0000142	.....
146,0000143	.....
148,0000146	.....
150,0000149	.....
152,0000152	.....
154,0000155	.....
156,0000159	.....
158,0000161	.....
160,0000163	.0085	
162,0000168	.....
164,0000170	.....
166,0000173	.....
168,0000178	.....
170,0000180	.....
172,0000183	.....
174,0000186	.....
176,0000191	.....
178,0000196	.....
180,0000204	.0110	
182,0000212	.....
184,0000219	.....
186,0000224	.....
188,0000227	.....
190,0000234	.....
192,0000240	.....
194,0000246	.....
196,0000251	.....
198,0000259	.....
200,0000276	.0159	
220,00008	.....
230,000	Scale started off web plate.
240,00006	.....
260,00012	.....
280,00019	.....
292,900	35,810	.....	.....	Tensile strength.

Sheared the rivets. Fractures started at side of a rivet hole in web plate.

No. 9395.

Marks, T 24.

$\frac{3}{4}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of web plate, $8''.46 \times '' .719$ square inches.. 6.08

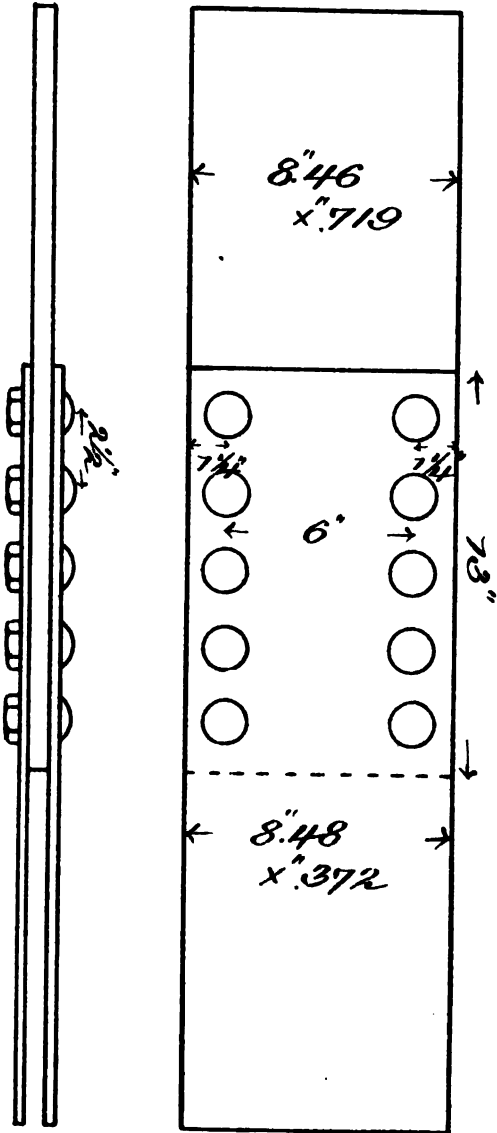
Shearing area of bolts, $'' .61$ diameter do..... 5.84

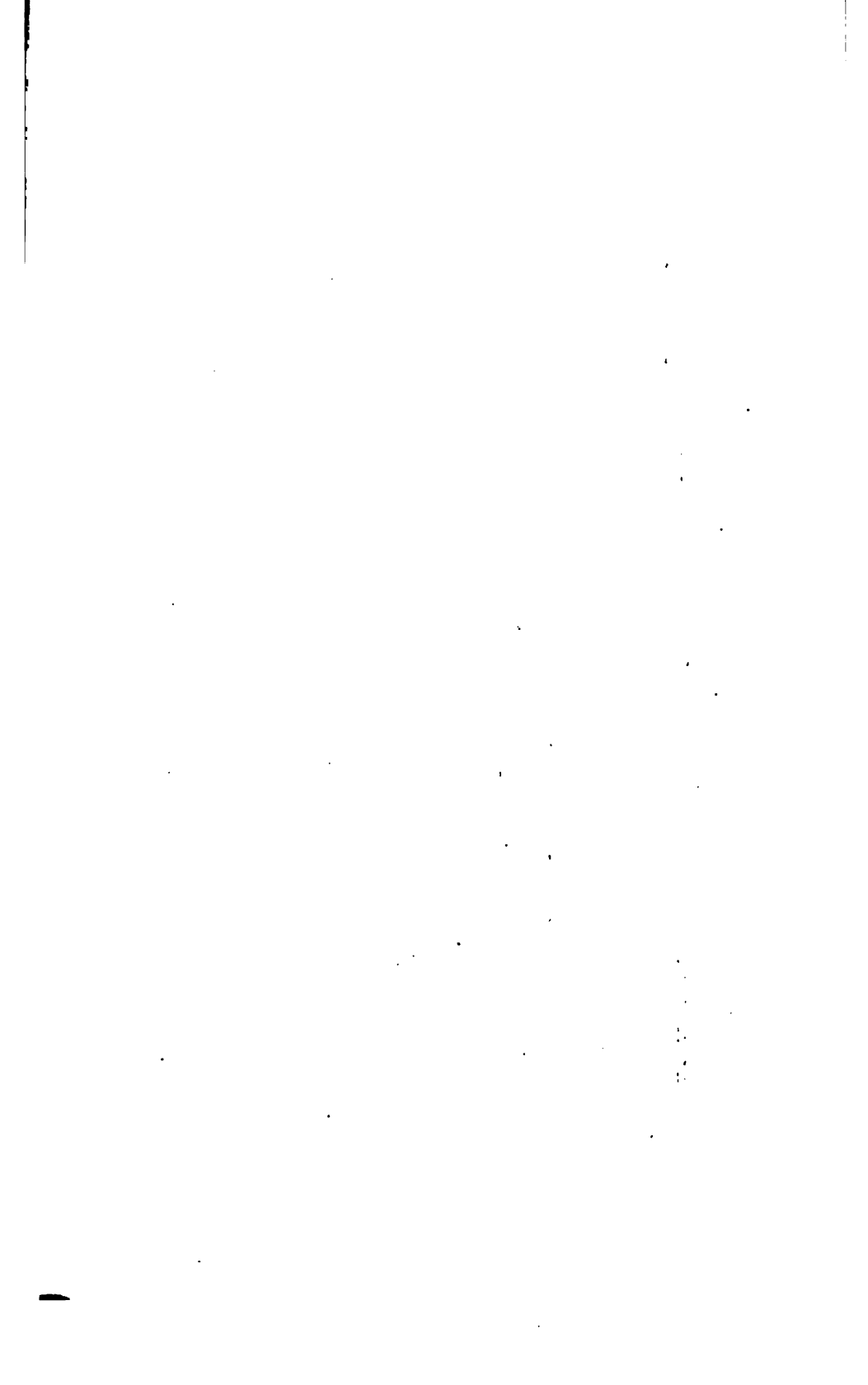
Gauged length, 15''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	0.	0.	Initial load.
1,0000000	.....
2,0000001	.....
4,0000002	.....
6,0000004	.....
8,0000005	.....
10,0000008	.....
12,0000008	.....
14,0000009	.....
16,0000011	.....
18,0000013	.....
20,0000015	.....
22,0000016	.....
24,0000018	.....
26,0000020	.....
28,0000022	.....
30,0000024	.....
32,0000026	.....
34,0000028	.....
36,0000029	.....
38,0000032	.....
40,0000034	.0008	
42,0000038	.....
44,0000041	.....
46,00006	.....
50,00006+	.....
60,00008	.....
70,00010	.....
80,00011	.....
90,00012	.....
100,00013	.....
110,00015	.....
120,00016	.....
130,00016+	.....
140,00017	.....
150,00019	.....
160,00021	.....
170,00025	.....
179,200	{ 29,470	Scale started off web plate.
	30,680	Tensile strength.
		Shearing strength of bolts.

Sheared the bolts.

No. 8395.





THE HISTORY OF THE

REPUBLIC OF THE UNITED STATES OF AMERICA

FROM THE EARLIEST SETTLEMENTS TO THE PRESENT

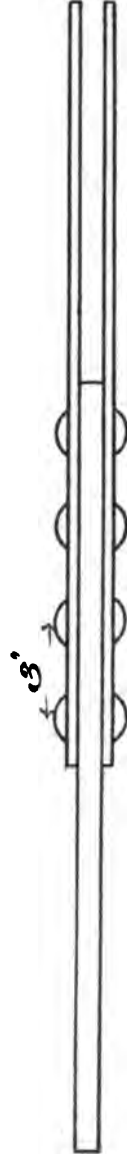
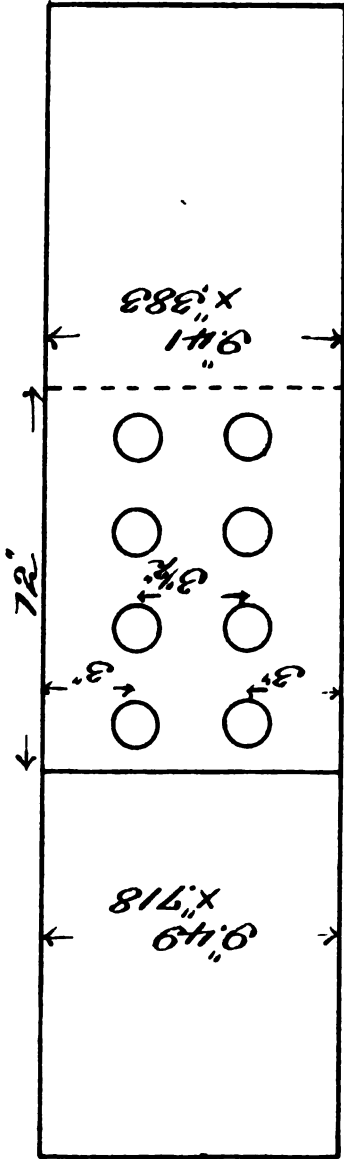
BY

JOHN F. JOHNSON

NEW YORK: THE UNIVERSITY PRESS OF THE COUNTRY

1912

No. 9396.



No. 9396.

Marks, T 15.

$\frac{3}{4}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate, $9''.49 \times \text{.718} = 6.81$ square inches.

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500		0.	0.	Initial load.
1,000		.0001		
2,000		.0001		
4,000		.0002		
6,000		.0003		
8,000		.0004		
10,000		.0005		
12,000		.0007		
14,000		.0008		
16,000		.0009		
18,000		.0010		
20,000		.0011		
22,000		.0012		
24,000		.0018		
26,000		.0014		
28,000		.0015		
30,000		.0016		
32,000		.0018		
34,000		.0019		
36,000		.0021		
38,000		.0022		
40,000		.0023	.0001	
42,000		.0024		
44,000		.0026		
46,000		.0027		
48,000		.0028		
50,000		.0029		
52,000		.0030		
54,000		.0031		
56,000		.0032		
58,000		.0034		
60,000		.0036	.0002	
62,000		.0037		
64,000		.0038		
66,000		.0040		
68,000		.0041		
70,000		.0042		
72,000		.0044		
74,000		.0046		
76,000		.0048		
78,000		.0050		
80,000		.0051	.0006	
82,000		.0054		
84,000		.0058		
86,000		.0060		
88,000		.0079		
90,000		.0087		
92,000		.0093		
94,000		.0098		
96,000		.0109		
98,000		.0107		
100,000		.0109	.0050	
102,000		.0112		
104,000		.0114		
106,000		.0118		
108,000		.0120		
110,000		.0124		
112,000		.0125		
114,000		.0131		
116,000		.0134		
118,000		.0137		
120,000		.0139	.0068	
122,000		.0144		
124,000		.0147		
126,000		.0150		
128,000		.0153		
130,000		.0158		
132,000		.0161		
134,000		.0168		

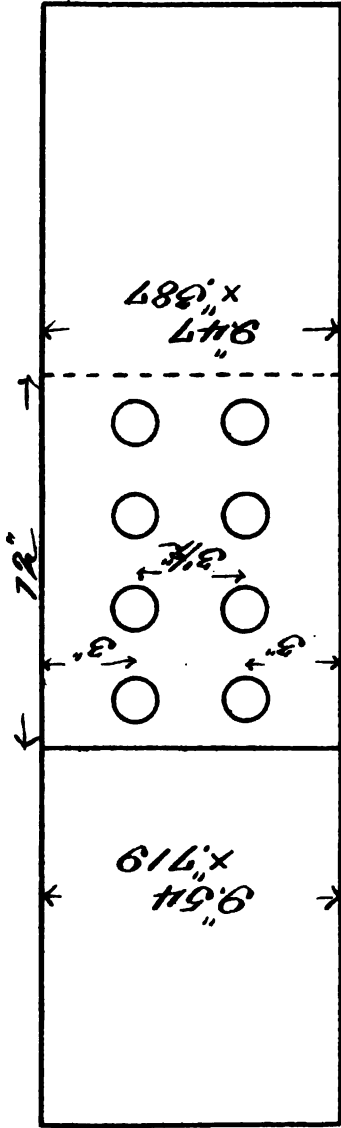
RIVETED AND BOLTED JOINTS.

No. 9396—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
134,0000173	
138,0000179	.....
140,0000185	.0097	
142,0000193	.....
144,0000195	.....
148,0000199	.....
148,0000213	.....
150,0000223	.....
152,0000231	.....
154,0000239	.....
158,0000256	.....
158,0000264	.....
180,0000277	.0157	
170,00003	.....
180,00004	.....
190,00008	.....
200,00009	.....
220,00014	.....
240,00023	.....
247,200	
	36,300	

Sheared the rivets.

No. 9397.



No. 9397.

Marks, T 16.

$\frac{3}{8}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of plate $9''.54 \times '' .719$square inches.. 6.86

Shearing area of bolts, $'' .61$ diameterdo..... 4.67

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
500	0.	0.	Initial load.
1,0000000	.....
2,0000001	.....
4,0000002	.....
6,0000003	.....
8,0000004	.....
10,0000006	.....
12,0000008	.....
14,0000009	.....
16,0000010	.....
18,0000011	.....
20,0000013	.....
22,0000015	.....
24,0000017	.....
26,0000019	.....
28,0000021	.....
30,0000024	.....
32,0000030	.....
34,0000037	.....
36,0000205	.....
38,0000259	.....
40,00003	.....
46,00004	.....
50,00005	.....
60,00006	.....
70,00007	.....
80,00007 †	.....
90,00009	.....
100,00010	.....
110,00011	.....
120,00012	.....
130,00013	.....
140,00014	.....
150,00016	.....
160,00018	.....
160,500	{ 23,890	Tensile strength.
	34.370	Shearing strength of bolts.

Sheared the bolts.

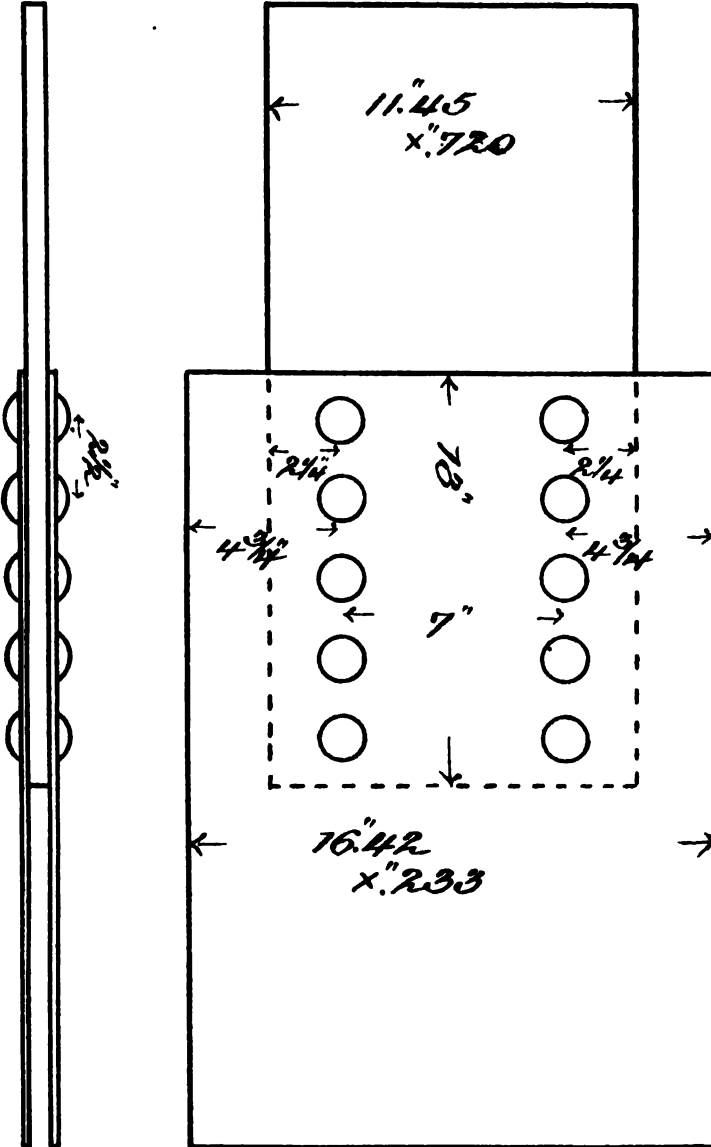
No. 9398.

Marks, T 27.

 $\frac{3}{4}$ " steel plate, $\frac{5}{8}$ " iron rivets.Punched holes; punch $\frac{11}{8}$ ", die $\frac{3}{4}$ " diameter.Gross sectional area of web plate, $11''.45 \times '' .720 = 16.42$ square inches.

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500	0.	0.	Initial load.
1,0000000	.....
2,0000001	.....
4,0000003	.....
6,0000005	.....
8,0000006	.....
10,0000008	.....
12,0000009	.....
14,0000011	.....
16,0000013	.....
18,0000014	.....
20,0000016	.....
22,0000018	.....
24,0000019	.....
26,0000020	.....
28,0000022	.....
30,0000024	.....
32,0000026	.....
34,0000027	.....
36,0000028	.....
38,0000029	.....
40,0000030	.0002	
42,0000032	.....
44,0000034	.....
46,0000035	.....
48,0000037	.....
50,0000039	.....
52,0000040	.....
54,0000041	.....
56,0000043	.....
58,0000045	.....
60,0000046	.0003	
62,0000048	.....
64,0000050	.....
66,0000051	.....
68,0000053	.....
70,0000055	.....
72,0000057	.....
74,0000059	.....
76,0000060	.....
78,0000062	.....
80,0000063	.0007	
82,0000065	.....
84,0000067	.....
86,0000069	.....
88,0000071	.....
90,0000073	.....
92,0000075	.....
94,0000077	.....
96,0000079	.....
98,0000081	.....
100,0000084	.0018	
102,0000086	.....
104,0000088	.....
106,0000098	.....
108,0000116	.....
110,0000120	.....
112,0000125	.....
114,0000129	.....
116,0000131	.....
118,0000134	.....
120,0000136	.0050	
122,0000139	.....
124,0000142	.....
126,0000145	.....



No. 9398.



No. 9398—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
128,000		.0147		
180,000		.0150		
132,000		.0153		
134,000		.0156		
136,000		.0159		
138,000		.0161		
140,000		.0164	.0062	
142,000		.0170		
144,000		.0173		
146,000		.0175		
148,000		.0179		
150,000		.0182		
152,000		.0184		
154,000		.0186		
156,000		.0188		
158,000		.0190		
160,000		.0191	.0072	
162,000		.0195		
164,000		.0197		
166,000		.0199		
168,000		.0201		
170,000		.0204		
172,000		.0206		
174,000		.0211		
176,000		.0214		
178,000		.0216		
180,000		.0220	.0089	
182,000		.0222		
184,000		.0227		
186,000		.0229		
188,000		.0232		
190,000		.0237		
192,000		.0241		
194,000		.0246		
196,000		.0257		
198,000		.0259		
200,000		.0265	.0122	
220,000		.03		
240,000		.04		
260,000		.10		
280,000		.16		
300,000		.24		
308,100	37,390			Tensile strength.

Sheared the rivets. Fractures started at sides of rivet holes in first row in the web plate.

No. 9399.

Marks, T 28.

$\frac{3}{4}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

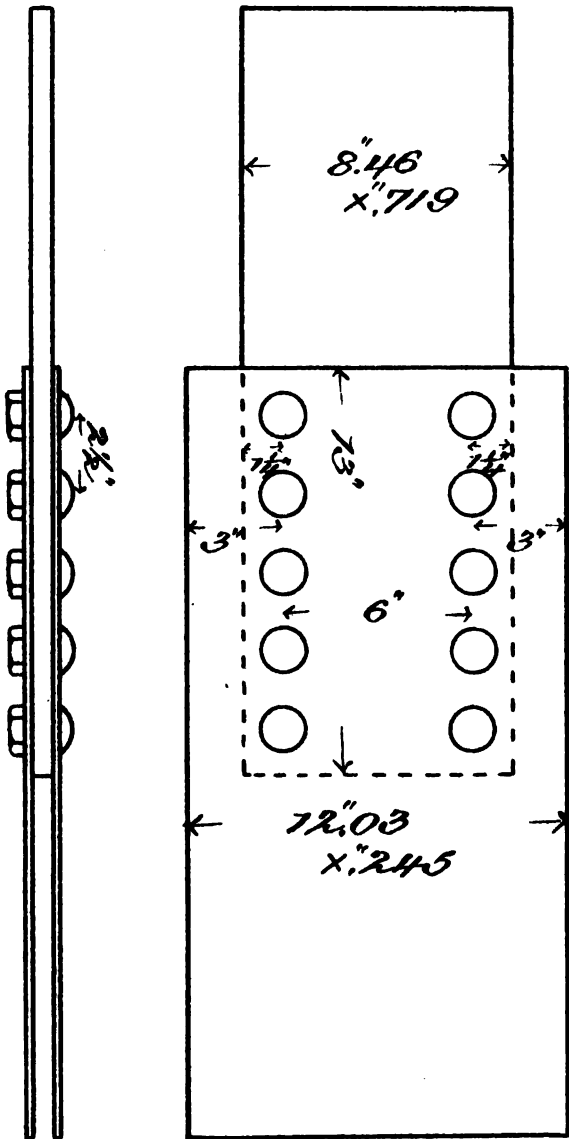
Gross sectional area of web plate, $8'' \times .46 \times .719$ square inches... 6.08

Shearing area of bolts, $.61$ diameter..... do..... 5.84

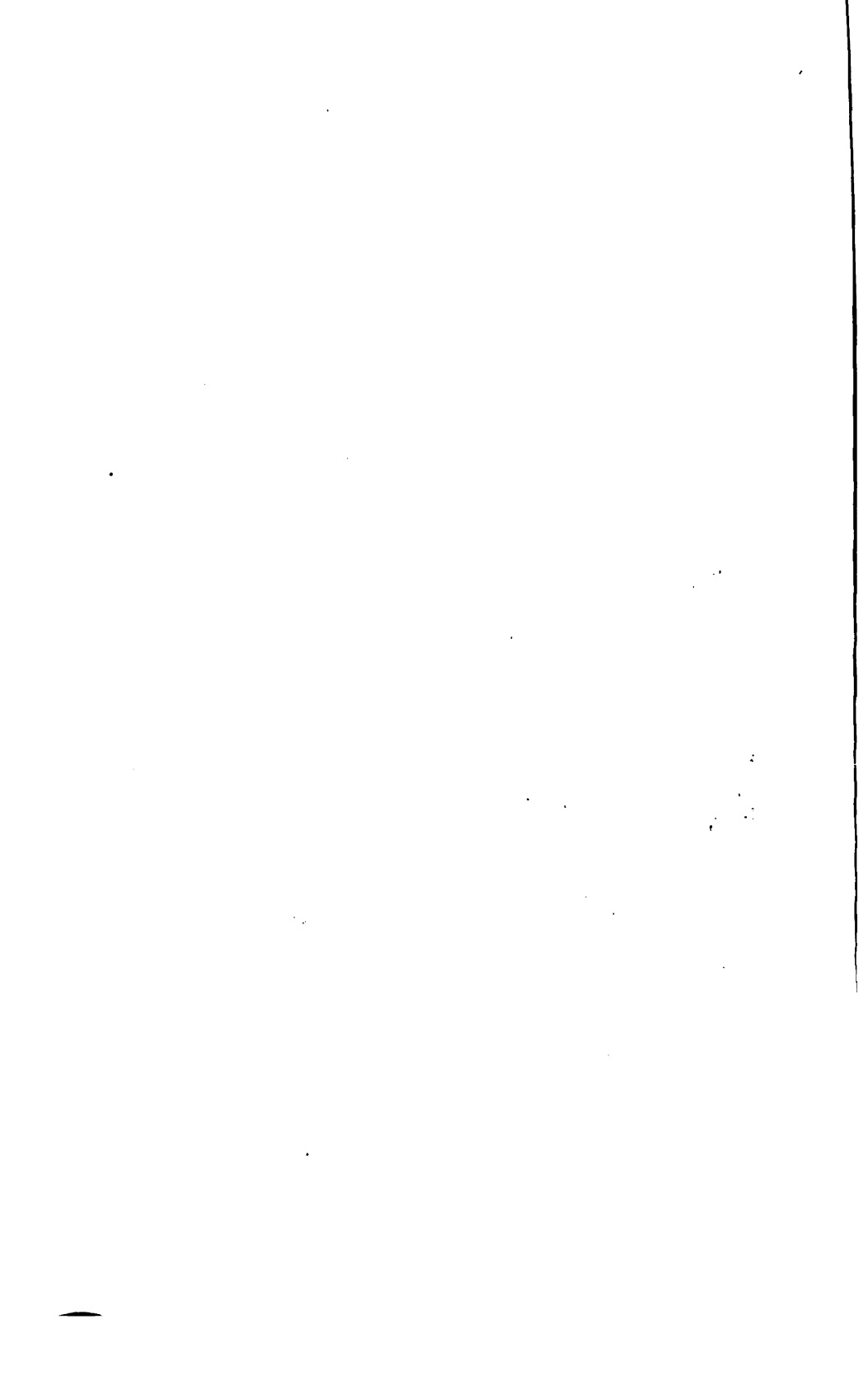
Gauged length, 15''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500		0.	0.	
1,000		.0001		
2,000		.0001		
4,000		.0003		
6,000		.0005		
8,000		.0006		
10,000		.0008		
12,000		.0010		
14,000		.0011		
16,000		.0012		
18,000		.0013		
20,000		.0015		
22,000		.0017		
24,000		.0019		
26,000		.0020		
28,000		.0022		
30,000		.0024		
32,000		.0025		
34,000		.0027		
36,000		.0029		
38,000		.0031		
40,000		.0032	.0004	
42,000		.0034		
44,000		.0036		
46,000		.0038		
48,000		.0040		
50,000		.0043		
52,000		.0047		
54,000		.0051		
56,000		.06		
60,000		.07		
70,000		.08		
80,000		.11		
90,000		.12		
100,000		.13		
110,000		.15		
120,000		.16		
130,000		.17		
140,000		.18		
150,000		.19		
160,000		.21		
170,000		.24		
189,900	{ 31,230	Tensile strength.
	{ 32,520	Shearing strength of bolts.

Sheared the bolts.

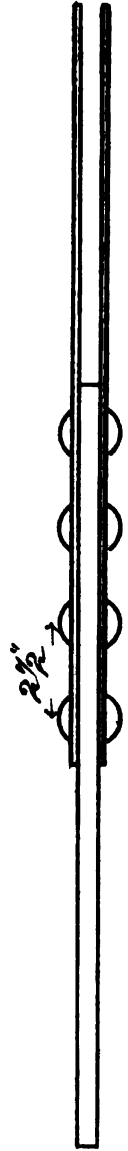
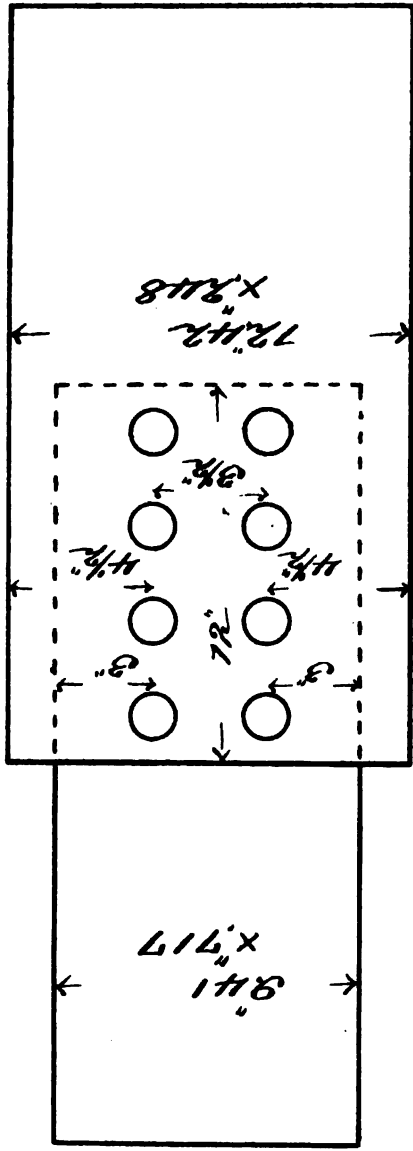


No. 9399.





No. 9400.



No. 9400.

Marks, T 19.

$\frac{3}{4}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $\frac{11}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of wet plate, $9''.41 \times '.717 = 6.75$ square inches.

Applied loads.		In gaged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	0.	0.	
1,0000001	.....
2,0000001	.....
4,0000002	.....
6,0000003	.....
8,0000004	.....
10,0000006	.....
12,0000007	.....
14,0000008	.....
16,0000009	.....
18,0000010	.....
20,0000012	.....
22,0000013	.....
24,0000014	.....
26,0000016	.....
28,0000018	.....
30,0000019	.....
32,0000020	.....
34,0000022	.....
36,0000023	.....
38,0000.24	.....
40,0000026	.0001	
42,0000027	.....
44,0000028	.....
46,0000029	.....
48,0000031	.....
50,0000032	.....
52,0000034	.....
54,0000036	.....
56,0000037	.....
58,0000039	.....
60,0000040	.0002	
62,0000042	.....
64,0000044	.....
66,0000046	.....
68,0000047	.....
70,0000049	.....
72,0000051	.....
74,0000053	.....
76,0000055	.....
78,0000058	.....
80,0000061	.0009	
82,0000065	.....
84,0000070	.....
86,0000076	.....
88,0000081	.....
90,0000086	.....
92,0000090	.....
94,0000095	.....
96,0000098	.....
98,0000102	.....
100,0000106	.0040	
102,0000109	.....
104,0000111	.....
106,0000115	.....
108,0000118	.....
110,0000121	.....
112,0000124	.....
114,0000127	.....
116,0000130	.....
118,0000132	.....
120,0000134	.0055	
122,0000138	.....
124,0000140	.....
126,0000143	.....
128,0000146	.....
130,0000148	.....
132,0000150	.....

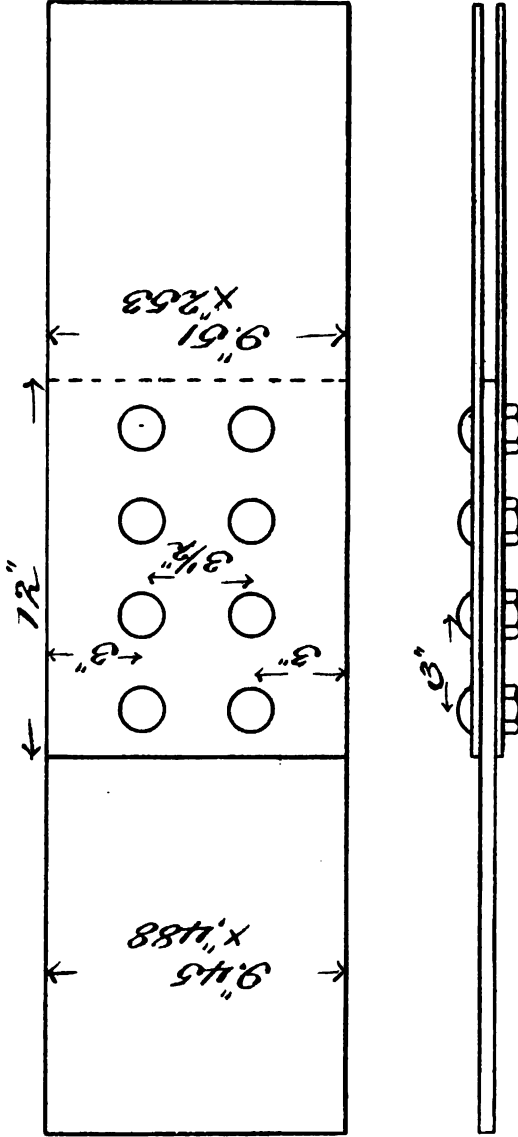
No. 9400—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
134,0000154	.....
136,0000156	.....
138,0000159	.....
140,0000163	.0069	
142,0000169	.....
144,0000172	.....
146,0000174	.....
148,0000178	.....
150,0000180	.....
152,0000185	.....
154,0000190	.....
156,0000194	.....
158,0000198	.....
160,0000203	.0090	
162,0000210	.....
164,0000212	.....
166,0000216	.....
168,0000224	.....
170,0000229	.....
172,0000236	.....
174,0000246	.....
176,0000254	.....
178,0000262	.....
180,0000270	.0139	
190,00003 +	.....
200,00006	.....
220,00018	.....
240,00022	.....
260,00035	.....
261,800	38,780	.....	.....	Tensile strength.

Sheared the rivets. Fractures started in first row of rivet holes in the web.



No. 9401.



No. 9401.

Marks, T 20.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $1\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of web plate, 9" .45 × " .488.....square inches.. 4.61
 Shearing area of bolts, ".61 diameterdo..... 4.67

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500		0.	0.	
1,000		.0001		
2,000		.0002		
4,000		.0005		
6,000		.0008		
8,000		.0009		
10,000		.0011		
12,000		.0013		
14,000		.0015		
16,000		.0017		
18,000		.0020		
20,000		.0022		
22,000		.0024		
24,000		.0026		
26,000		.0028		
28,000		.0032		
30,000		.0035		
32,000		.0036		
34,000		.0038		
36,000		.0041		
38,000		.0044		
40,000		.0046	.0002	
42,000		.0049		
44,000		.0052		
46,000		.0054		
48,000		.0057		
50,000		.0061		
52,000		.05		
60,000		.08		
70,000		.09		
80,000		.11		
90,000		.12		
100,000		.13		
110,000		.14		
120,000		.16		
130,000		.17		
140,000		.19		
144,200	{ 31,280	Tensile strength.
	{ 30,880	Shearing strength of bolts.

Sheared the bolts.

No. 9402.

Marks, T7.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of web plate, $10''.18 \times ''\text{.487}$ square inches . 4.96

Net sectional area of covers, $9''.17 \times ''\text{.24}$ do..... 2.20

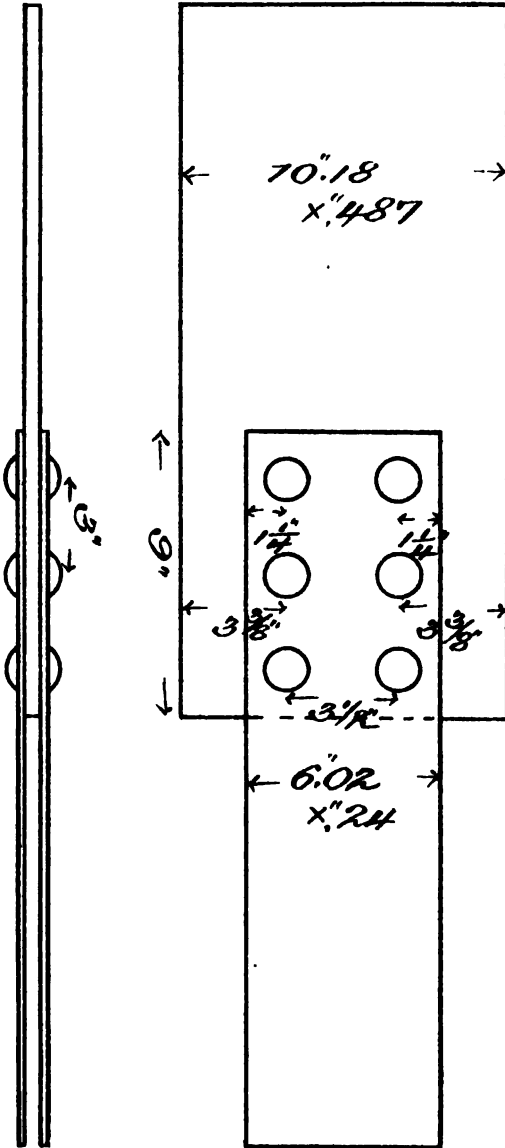
Gauged length, 15".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
500		0.		Initial load	
1,000		.0000			
2,000		.0002			
4,000		.0005			
6,000		.0007			
8,000		.0010			
10,000		.0014			
12,000		.0017			
14,000		.0021			
16,000		.0024			
18,000		.0027			
20,000		.0029			
22,000		.0032			
24,000		.0035			
26,000		.0037			
28,000		.0039			
30,000		.0043			
32,000		.0044			
34,000		.0048			
36,000		.0051			
38,000		.0054			
40,000		.0058	.0002		
42,000		.0060			
44,000		.0063			
46,000		.0065			
48,000		.0069			
50,000		.0072			
52,000		.0075			
54,000		.0078			
56,000		.0081			
58,000		.0085			
60,000		.0087	.0007		
62,000		.0090			
64,000		.0084			
66,000		.0087			
68,000		.0101			
70,000		.0106			
72,000		.0111			
74,000		.0120			
76,000		.0126			
78,000		.0131			
80,000		.0136			
82,000		.0143			
84,000		.0148			
86,000		.0152			
88,000		.0157			
90,000		.0161			
92,000		.0166			
94,000		.0170			
96,000		.0175			
98,000		.0180			
100,000		.0184	.0051		
102,000		.0182			
104,000		.0196			
106,000		.0202			
108,000		.0207			
110,000		.0212			
112,000		.0219			
114,000		.0228			
116,000		.0238			
118,000		.0256			
120,000	24,190	.03			Tensile strength.

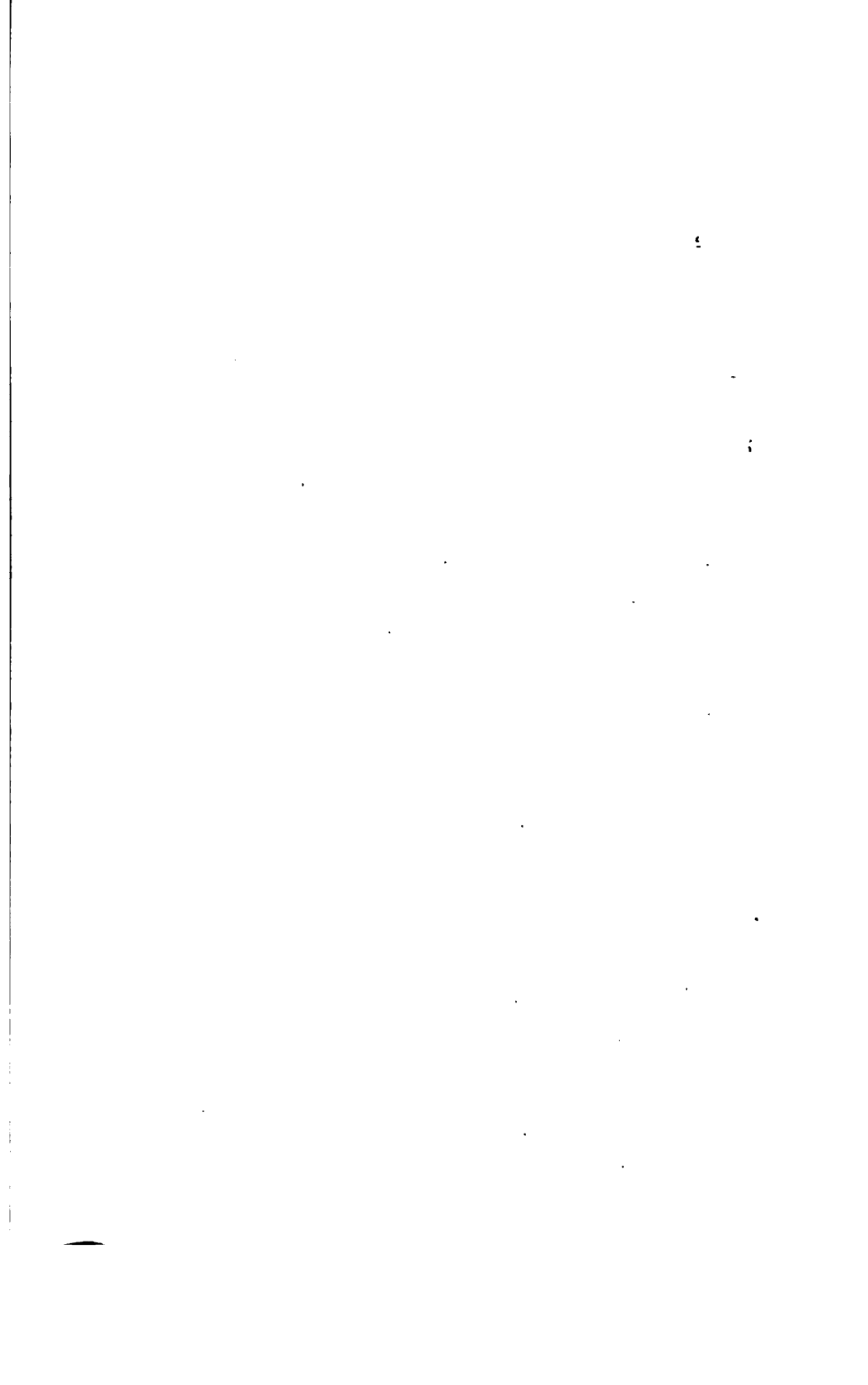
Fractured the covers through first row of rivet holes. Appearance granular next sides of holes, silky metal balance of fractures.

Maximum stress on joint.

Tension on gross section of web plate pounds per square inch.. 24,190
 Tension on net section of covers do..... 54,540

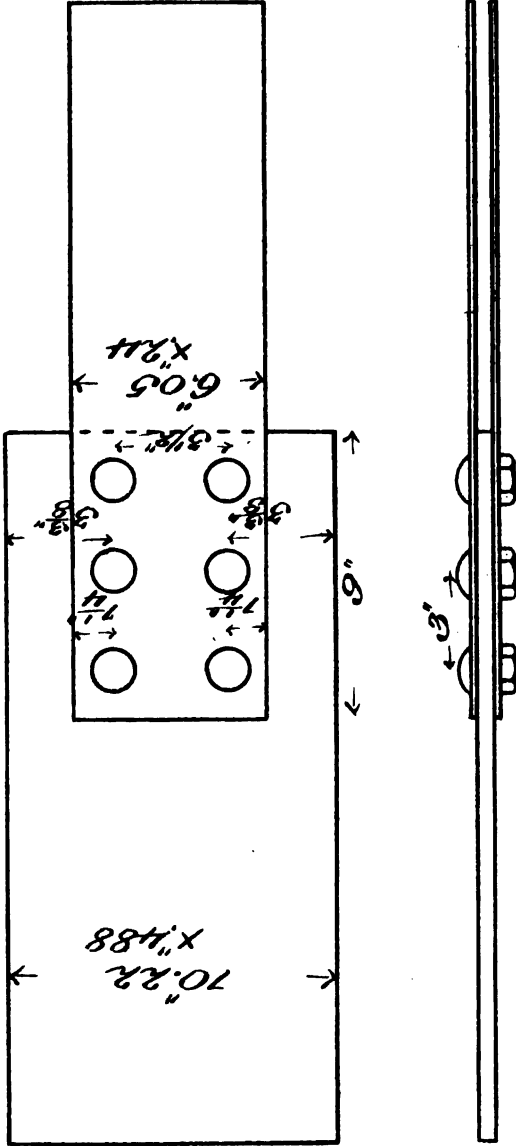


No. 9402.





No. 9403.



No. 9403.

Marks, T 8.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of web plate, $10''.22 \times '' .488$square inches.. 4.99

Shearing area of bolts, $'' .61$ diameter.....do..... 3.50

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500	0.	0.	
1,0000001	.....
2,0000002	.....
4,0000005	.....
6,0000007	.....
8,0000010	.....
10,0000012	.....
12,0000015	.....
14,0000018	.....
16,0000021	.....
18,0000023	.....
20,0000026	.....
22,0000029	.....
24,0000032	.....
26,0000035	.....
28,0000041	.....
30,00005	.....
40,00008	.....
50,00012	.....
60,00015	.....
70,00017	.....
80,00019	.....
90,00021	.....
100,00026	.....
103,500	{ 20,740	Tensile strength.
	29,570	Shearing strength of bolts.

Sheared the bolts. Started fractures at sides of holes in first row in covers.

No. 9404.

Marks T 11.

$\frac{1}{2}$ " steel plate, $\frac{5}{8}$ " iron rivets.

Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of web plate, $10'.22 \times '.256$ square inch.. 2.62

Net sectional area of web plate, $8'.78 \times '.256$do.... 2.25

Gauged length, 15".

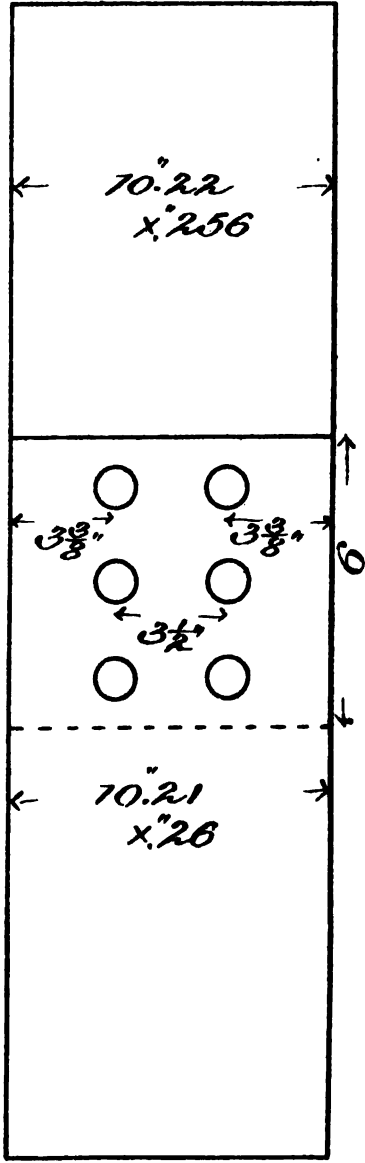
Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
500		0.	0.	Initial load.
1,000		.0002		
2,000		.0003		
4,000		.0006		
6,000		.0009		
8,000		.0013		
10,000		.0017		
12,000		.0021		
14,000		.0025		
16,000		.0028		
18,000		.0032		
20,000		.0036		
22,000		.0039		
24,000		.0042		
26,000		.0046		
28,000		.0049		
30,000		.0052		
32,000		.0056		
34,000		.0059		
36,000		.0063		
38,000		.0067		
40,000		.0070	.0008	
42,000		.0074		
44,000		.0079		
46,000		.0083		
48,000		.0086		
50,000		.0090		
52,000		.0095		
54,000		.0099		
56,000		.0104		
58,000		.0109		
60,000		.0114	.0023	
62,000		.0121		
64,000		.0127		
66,000		.0134		
68,000		.0142		
70,000		.0149		
72,000		.0156		
74,000		.0164		
76,000		.0172		
78,000		.0179		
80,000		.0187	.0070	
82,000		.0197		
84,000		.0204		
86,000		.0213		
88,000		.0223		
90,000		.0236		
92,000		.0249		
94,000		.0265		
96,000		.0288		
98,000		.05		
109,900	41,950			Tensile strength.

Fractured web plate across first row of rivet holes.

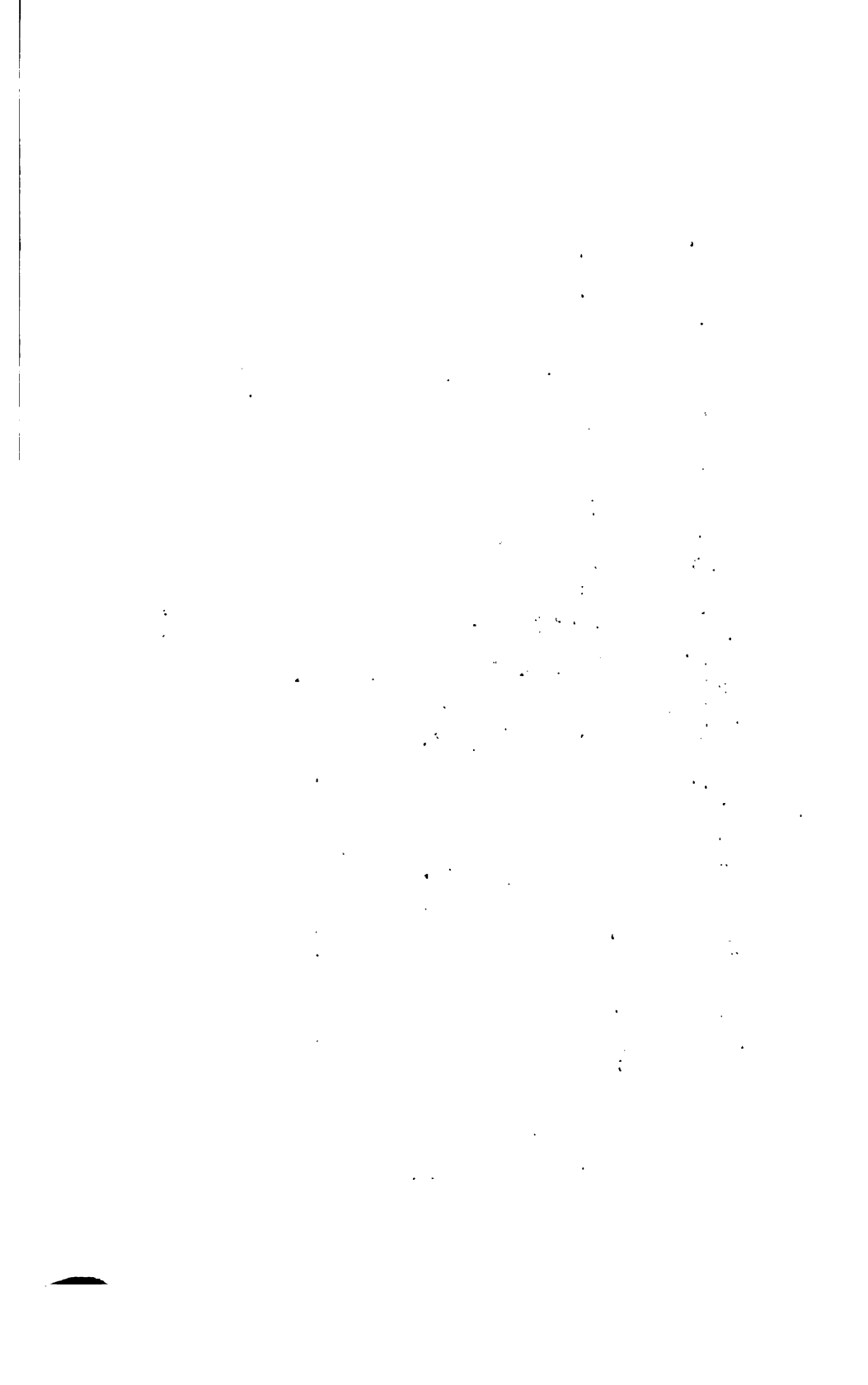
Granular metal at sides of one hole, silky appearance elsewhere.

Maximum stress on joint.

Tension on gross section of web platepounds per square inch.. 41,950
 Tension on net section of web plate.....do.... 48,840

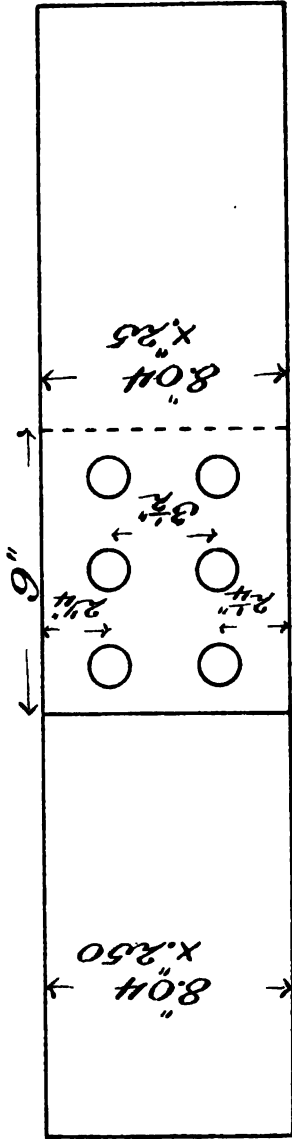


No. 9404.





No. 9405.



No. 9405.

Marks, T 12.

$\frac{1}{4}$ " steel plate, $\frac{5}{8}$ " iron bolts.

Punched holes; punch $1\frac{1}{8}$ ", die $\frac{3}{4}$ " diameter.

Gross sectional area of web plate, $8''.04 \times '' .250$square inches.. 2.01

Net sectional area of web plate, $6''.60 \times '' .250$do..... 1.65

Shearing area of bolts, $'' .61$ diameter.....do..... 3.50

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i> 0.	<i>Inch.</i> 0.	
500				Initial load.
1,000		.0001		
2,000		.0002		
4,000		.0005		
6,000		.0008		
8,000		.0011		
10,000		.0016		
12,000		.0020		
14,000		.0024		
16,000		.0027		
18,000		.0030		
20,000		.0034		
22,000		.0037		
24,000		.0040		
26,000		.0044		
28,000		.0048		
30,000		.0051		
32,000		.0056		
34,000		.0060		
36,000		.0064		
38,000		.0069		
40,000		.0072	.0008	
42,000		.0076		
44,000		.0081		
46,000		.0085		
48,000		.0090		
50,000		.0098		
52,000		.11		
60,000		.14		
70,000		.16		
80,000		.30		
80,400	40,000			Tensile strength.

Fractured web plate across first row of rivet holes. Silky.

Maximum stress on joint.

Tension on gross section of web plate..... pounds per square inch.. 40,000
 Tension on net section of web platedo..... 48,730
 Shearing on bolts.....do..... 22,970

No. 9406.

Marks, T 1.

Angle, 3" x 3" x $\frac{3}{8}$ ", $\frac{5}{8}$ " iron rivets.Punched holes; punch $\frac{11}{16}$ ", die $\frac{3}{4}$ " diameter.

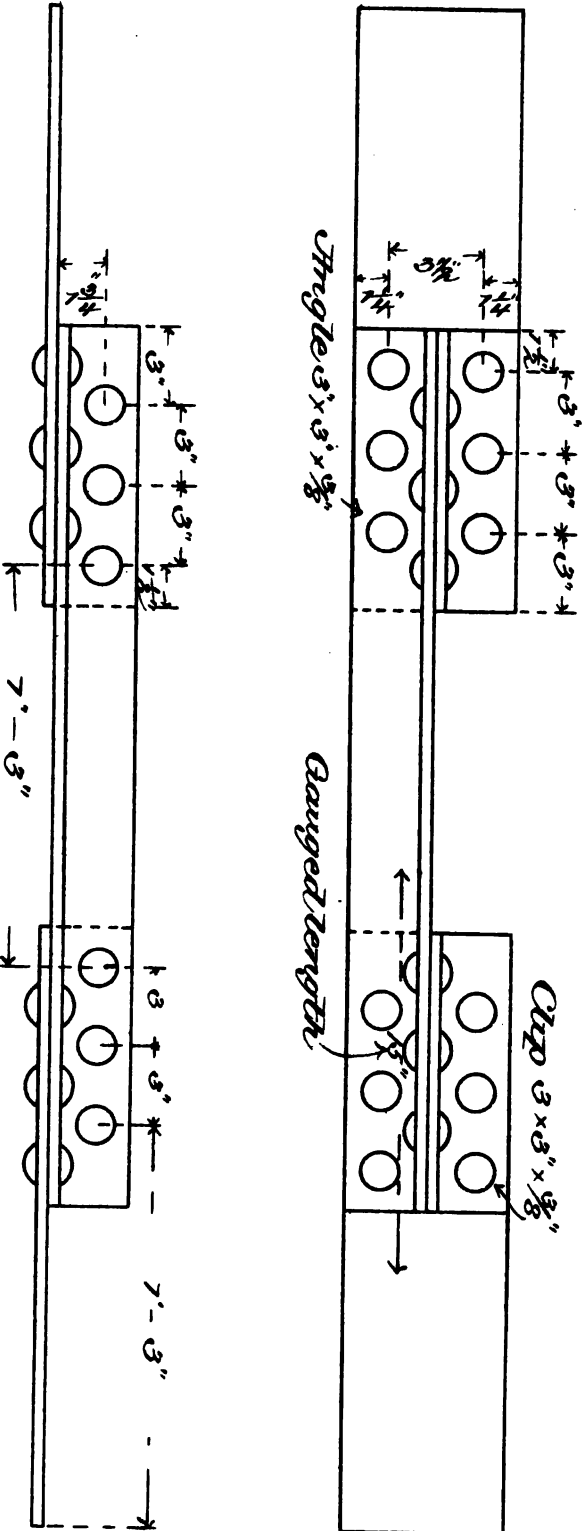
Gross sectional area of angle (approximate), 2.11 square inches.

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.	
500	0.	0.		
1,000	0.	.....	
1,5000003	.....	
2,0000005	.....	
2,5000006	.....	
3,0000008	.....	
4,0000010	.....	
5,0000012	.....	
6,0000015	.....	
7,0000017	.....	
8,0000020	.....	
9,0000022	.....	
10,0000024	.....	
11,0000027	.....	
12,0000030	.....	
13,0000035	.....	
14,0000039	.....	
15,0000044	.....	
16,0000048	.....	
17,0000054	.....	
18,0000059	.....	
19,0000066	.....	
20,0000071	.0014		
21,0000081	.....	
22,0000087	.....	
23,0000094	.....	
24,0000104	.....	
25,0000110	.....	
26,0000120	.....	
27,0000130	.....	
28,0000138	.....	
29,0000146	.....	
30,0000154	.0051		
31,0000165	.....	
32,0000172	.....	
33,0000180	.....	
34,0000190	.....	
35,0000199	.....	
36,0000210	.....	
37,0000222	.....	
38,0000234	.....	
39,0000246	.....	
40,0000269	.0133		
41,0000300	.....	
44,00004	.....	
48,00006	.....	
50,100	23,740		Tensile strength.

Fractured angle bar at opposite end from the gauged length. Line of fracture extended through first rivet hole in each leg. Appearance, granular.

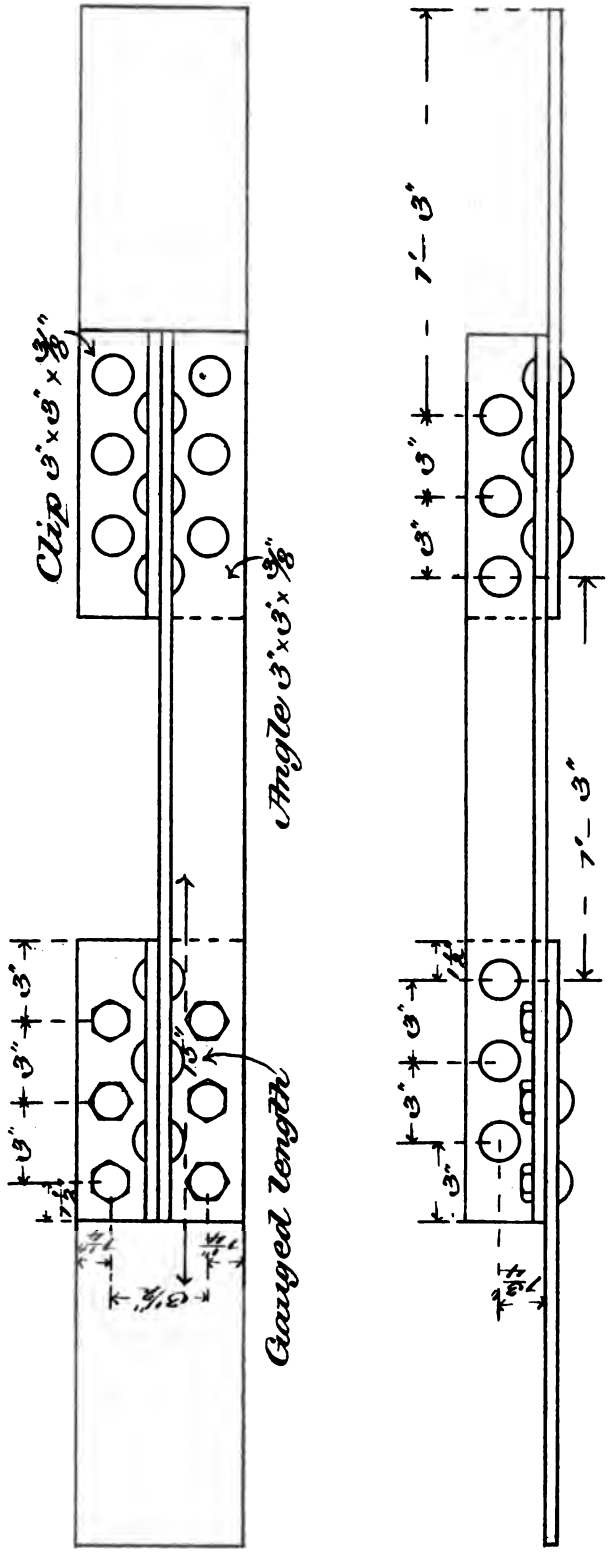
No. 9406.







No. 9407



No. 9407.

Marks, T 2.

Angle, 3'' x 3'' x 3/8'', 5/8'' iron rivets and bolts.

Punched holes; punch 1 1/8'', die 3/4'' diameter.

Gross sectional area of angle (approximate).....square inches.. 2.11

Shearing area of bolts.....do.... 1.75

Gauged length, 15''.

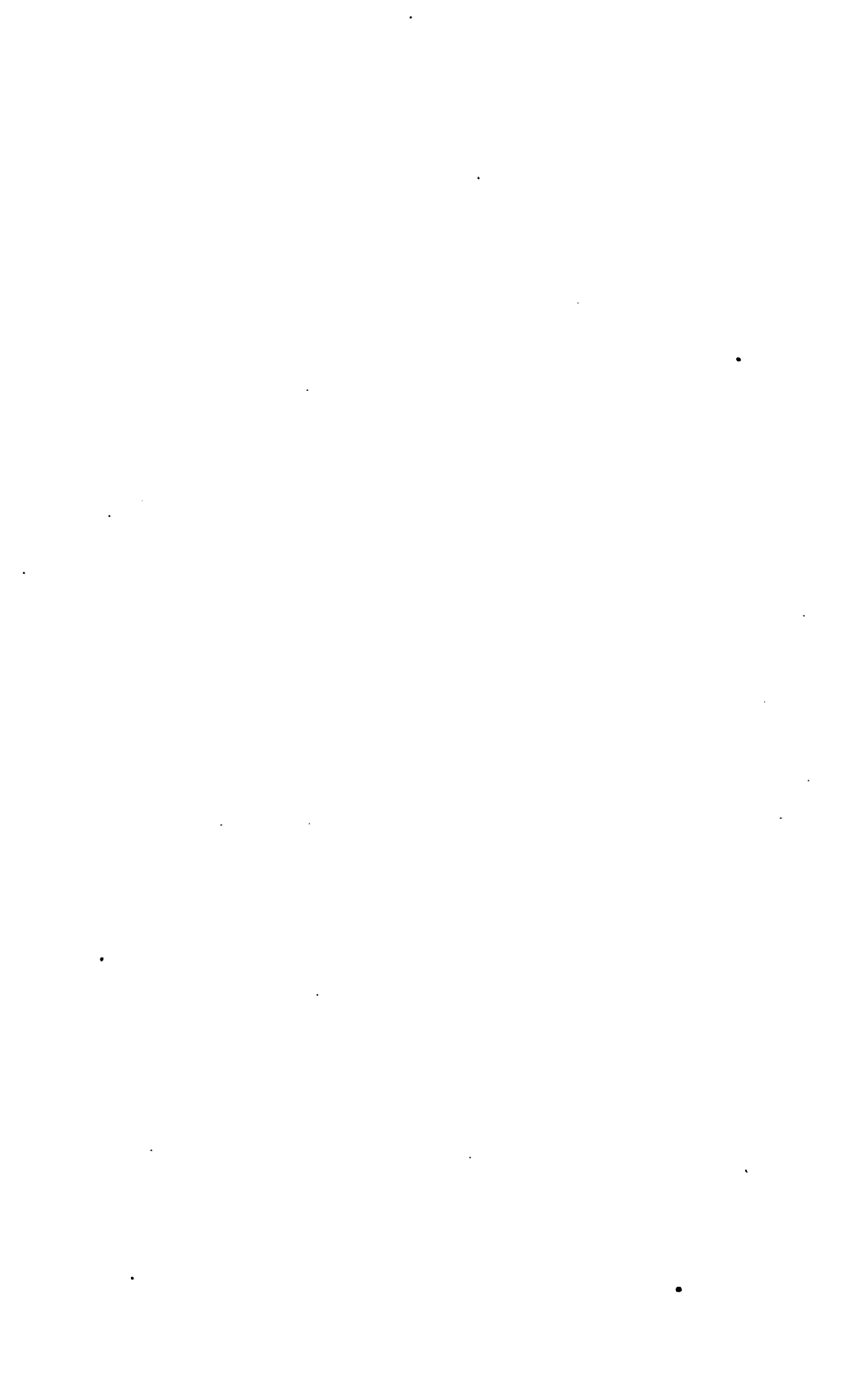
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
500		0.	0.	
1,000		.0002		
1,500		.0004		
2,000		.0005		
2,500		.0007		
3,000		.0009		
4,000		.0012		
5,000		.0016		
6,000		.0020		
7,000		.0024		
8,000		.0029		
9,000		.0033		
10,000		.0038		
11,000		.0044		
12,000		.0048		
13,000		.0052		
14,000		.0059		
15,000		.0066		
16,000		.0074		
17,000		.0083		
18,000		.0096		
19,000		.0120		
20,000		.0146	.0087	
21,000		.0208		
22,000		.11		
26,000		.12		
30,000		.16		
31,000		.18		
38,000		.21		
42,000		.25		
46,000		.29		
50,000		.35		
50,800	{ 21,080	Tensile strength.
	{ 29,030	Shearing strength of bolts.

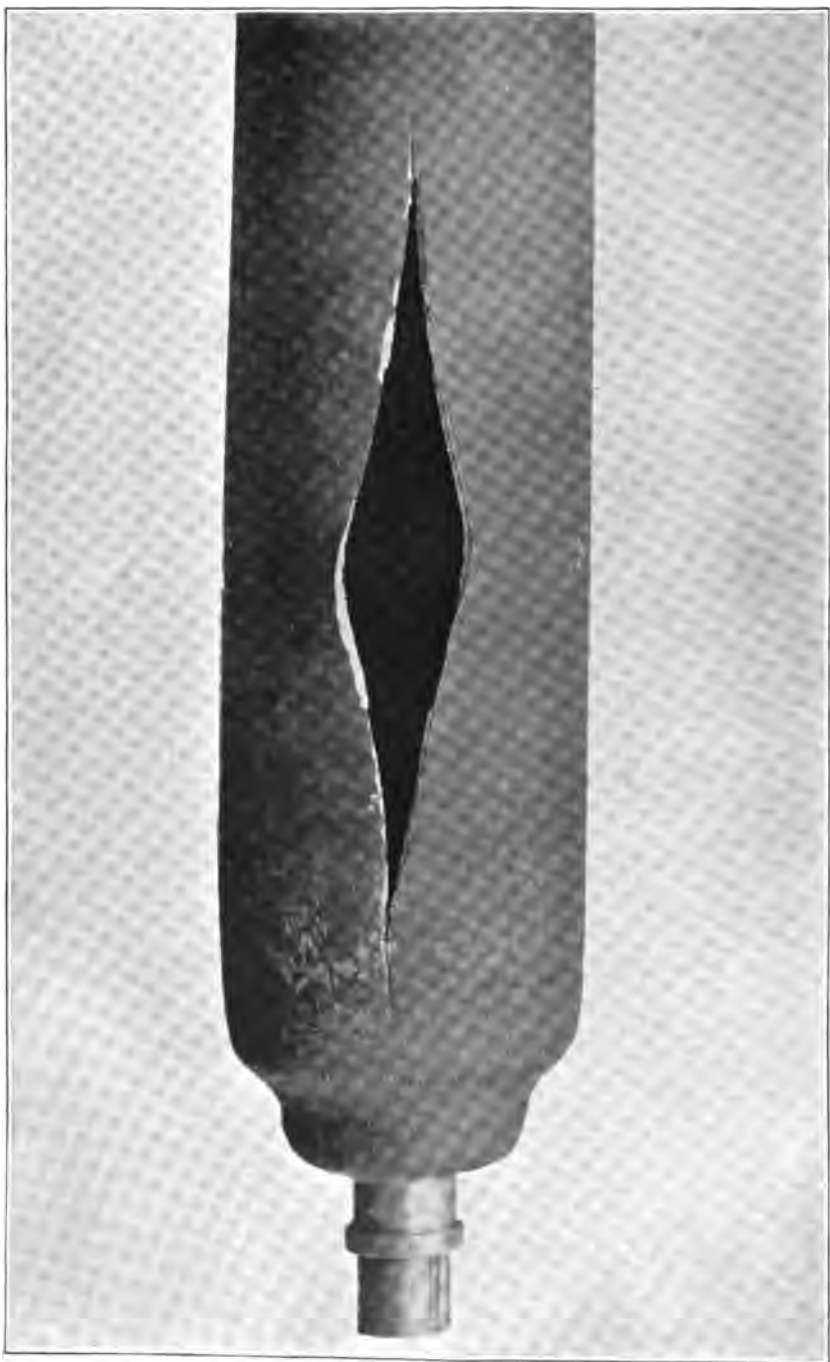
Sheared the bolts. A small crack was started at the first rivet hole in the lower leg of the angle.



GAS TUBE.

**HYDROSTATIC TEST, WITH INTERIOR PRESSURE, OF A GAS
TUBE FOR THE UNITED STATES SIGNAL SERVICE.**





PHOTOGRAPH SHOWING RUPTURE IN GAS TUBE AFTER THE TEST.

TUBE MADE BY THE MANNESMAN TUBE COMPANY, NEW YORK.

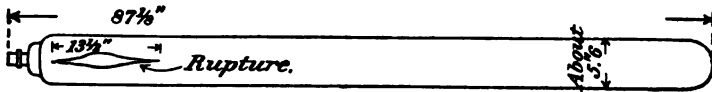
The tube was tested by means of piping connected with a reservoir cylinder placed in the testing machine. The piston of this reservoir was 3".37 diameter; sectional area, 8.92 square inches.

The total loads applied refer to this piston. There was no leakage of the connections, hence the piston travel closely indicates the time when the tube reached its elastic limit, which occurred at 4,710 pounds per square inch, as shown by the increased rate of travel of the piston and the gradual yielding of the tube under sustained pressure.

Between the load at the elastic limit and time of final rupture, scale started off the exterior surface of the tube in minute flakes at places along its length, but without general scaling.

At a place 25" to 31" from the closed end a seam in the exterior surface slightly opened, this seam being about 90° from the side on which final rupture occurred.

No. 8312.



Weight, 82 pounds.

Applied loads.		Piston projects.	Remarks.
Total.	Per square inch.		
Pounds.	Pounds.	Inches.	
8,920	1,000	14.41	
17,840	2,000	13.53	
26,760	3,000	12.73	
35,680	4,000	11.95	
87,000		11.83	
38,000		11.75	
39,000		11.65	
40,000		11.54	
41,000		11.42	
42,000	4,710	11.18	Elastic limit.
42,000	4,710	11.03	After 3 minutes.
42,000	4,710	10.94	After 5 minutes.
42,500		10.83	
42,500		10.46	Do.
43,000		10.36	
43,000		10.01	Do.
43,500		9.90	
44,000		9.75	
44,600	5,000	9.28	
44,600	5,000	8.19	Do.
46,000		7.35	
47,000		5.83	
47,500		5.02	
48,000		4.08	
49,000		2.65	
8,920	1,000	16.76	New stroke of piston taken.
44,600	5,000	13.24	
49,000		12.73	
50,000		11.81	
51,000		10.56	
52,000		9.40	
52,300	5,863		Ultimate strength.

A longitudinal rupture occurred at the nipple end of the tube, extending about 13 1/2" along the length of the tube. Appearance silky, lamellar.

WROUGHT-IRON BARS FROM BERLIN IRON BRIDGE COMPANY.

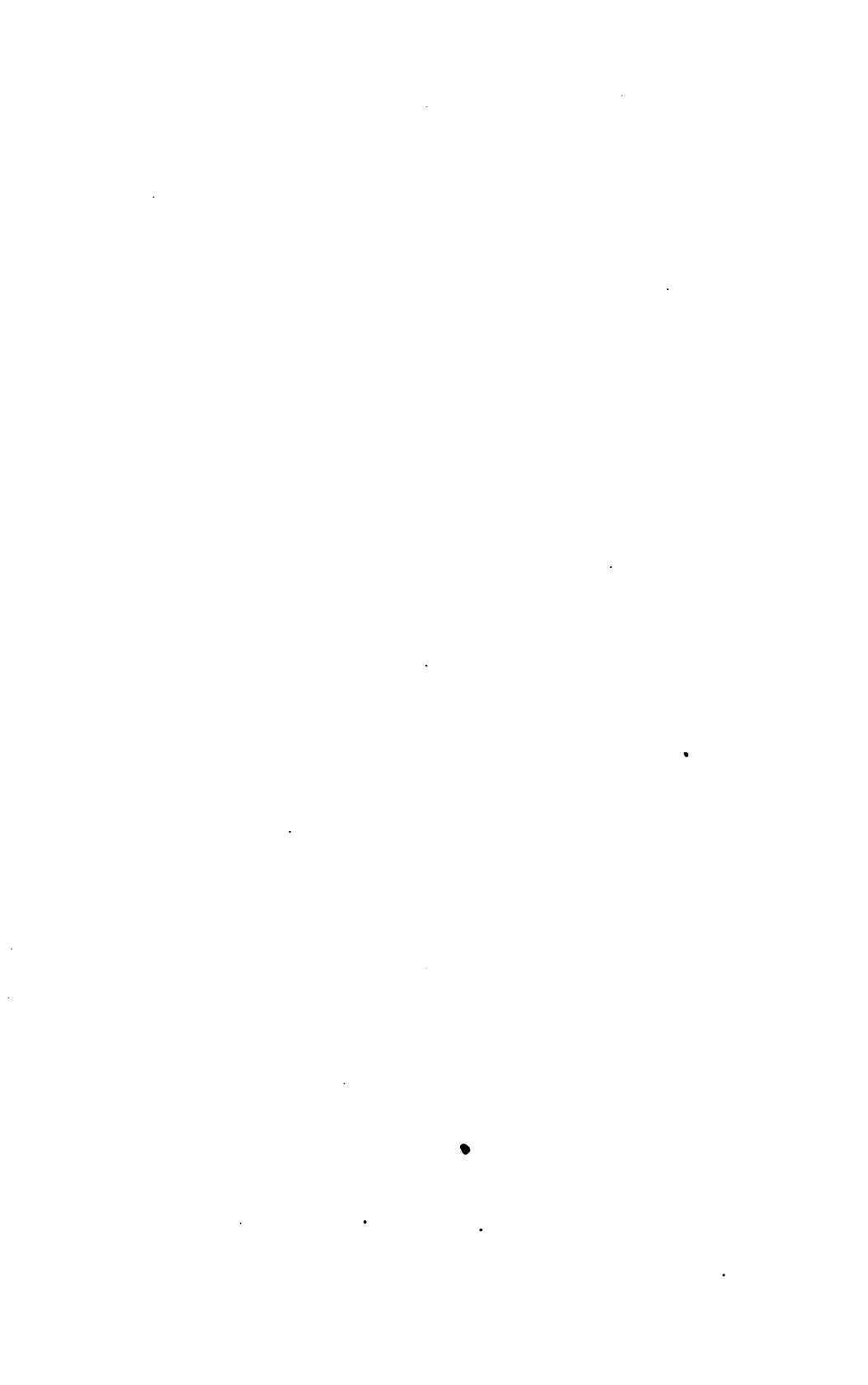


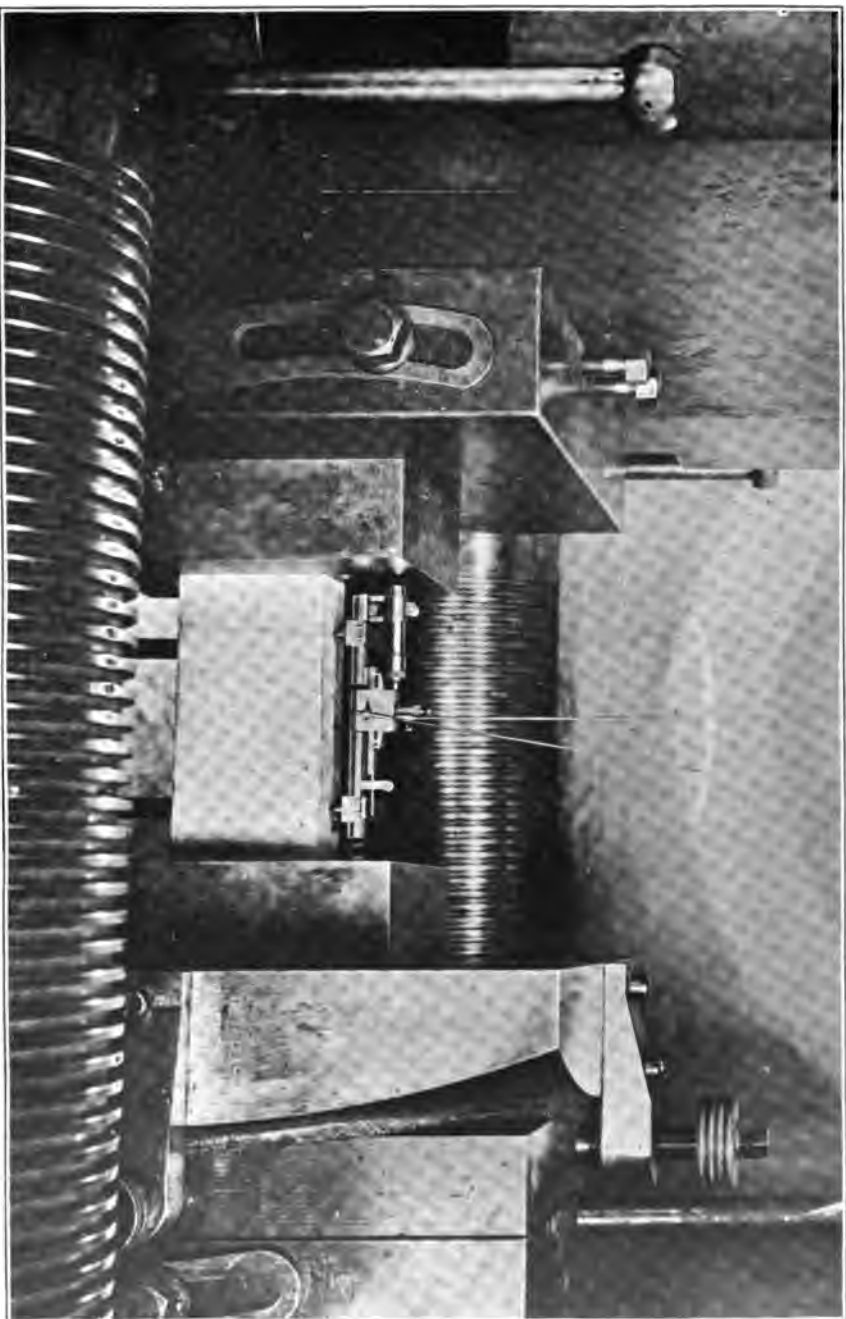
No. of test.	Diameter.	Sec-tional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Con- traction of area.	Appearance of fracture.	Elongation of inch sections.
			Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
9345	Inch. .58	Sq. in. .264	Pounds. 9,750	Pounds. 36,930	Pounds. 14,280	Pounds. 54,090	1.87	23.4	Inch. Sq. in. .42 = .139	Per ct. 47.3		" " " " " " " "
9346	.58	.264	10,200	38,640	14,310	54,200	1.86	24.5	Diam., .45 = .159	39.8	Fibrous	.16, .21, .21, .21, .48, .22, .20, .18
											.....do	.17, .21, .22, .22, .23, .25, .40*, .26

BRICKS.

ABSORPTION OF WATER AND COMPRESSIVE ELASTIC
PROPERTIES, AND EXPANSION DUE
TO HEAT AND COLD.

BUILDING MATERIAL TESTS, CONTINUED FROM REPORT OF 1896.





THE ELASTIC PROPERTIES OF BRICKS.
PHOTOGRAPH SHOWING MICROMETER IN POSITION ON BRICK FOR MEASURING THE COMPRESSIONS.



BRICKS.

ABSORPTION OF WATER.

No. of test compressive elastic properties.	Contributor.	Absorption of water.							
		Weight, dry.		After soaking one week.		After passing through cold, hot and cold baths.		Increase after soaking first week.	
				By weight.	By volume.	By weight.	By volume.	By weight.	By volume.
		Lbs.	Oz.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
1373	Kansas City Hydraulic Press Brick Co.....	5	7	12.1	23.0	14.1	26.8	2.0	3.8
1874	do.....	5	6½	10.7	20.6	13.0	25.1	2.3	4.5
1378	The Powhatan Clay Manufacturing Co.....	5	½	11.2	20.9	14.3	26.7	3.1	5.8
1377	do.....	4	10½	6.7	14.4	8.4	18.0	1.7	3.6
1870	The Hydraulic Press Brick Co.....	5	½	15.9	28.2	18.1	32.0	2.2	3.8
1371	do.....	5	9½	7.5	15.3	11.4	23.2	3.9	7.9
1372	do.....	5	11½	9.0	17.7	12.0	23.7	3.0	6.0
1881	Philadelphia and Boston Face Brick Co.....	5	3½	19.5	33.1	21.2	36.2	1.7	3.1
1882	do.....	5	6½	17.6	31.0	19.3	34.0	1.7	3.0
1886	do.....	5	1½	4.6	10.2	6.2	13.6	1.6	3.4
1884	do.....	4	5	17.7	29.8	21.0	35.3	3.3	5.5
1885	do.....	4	15½	10.7	21.1	12.6	24.8	1.9	3.7
1865	Eastern Hydraulic Press Brick Co.....	5	7½	7.1	14.8	8.5	17.8	1.4	3.0
1366	do.....	5	4½	7.4	14.4	9.2	18.7	1.8	4.3
1367	do.....	5	6½	6.1	12.6	8.4	17.4	2.3	4.8
1375	Brooke Terra Cotta Co.....	5	14½	6.6	13.0	10.8	21.3	4.2	8.3
1376	do.....	5	15½	5.5	11.4	8.1	16.9	2.6	5.5
1380	Gladding McBean & Co.....	5	10½	5.8	12.0	10.2	21.2	4.4	9.2
1379	do.....	5	10½	11.6	22.6	13.8	26.3	2.0	3.7
1364	Northern Hydraulic Press Brick Co.....	5	5½	13.5	24.9	15.8	29.2	2.3	4.3
1368	Chicago Hydraulic Press Brick Co.....	5	4½	9.4	19.0	10.9	22.0	1.5	3.0
1868	Clark Press Brick Co.....	5	8	7.7	14.1	13.1	24.1	5.4	10.0

COMPRESSIVE ELASTIC PROPERTIES.

The bricks were prepared for testing with their ends ground flat, and were loaded endwise in the testing machine.

Observations were made on the compressibility of the bricks in the direction of loading, and the lateral expansion of the material was determined on a transverse gauged length taken at right angles to the direction of loading.

Values of the moduli of elasticity ranged from 820,000 pounds per square inch for a soft fire brick to 7,200,000 pounds per square inch the value found for a hard paving brick.

The ratios of lateral expansion to longitudinal compression generally fell between the limits of $\frac{1}{1.5}$ and $\frac{1}{10.5}$. In one instance the apparent ratio was $\frac{1}{1.5}$, but this exceptionally large value was attributable to the heterogeneous condition of the brick, which was softer and more compressible immediately under the transverse gauged length than elsewhere along its length.

An exceptionally small ratio, $\frac{1}{51.7}$, was shown by a fire brick of low compressive modulus of elasticity.

The coefficients of expansion by heat were determined with certain bricks which had been examined for compressive elastic properties and reported in 1895.

The absorption of water was observed after one week's immersion in a bath at atmospheric temperature, and was again observed after the brick had passed through the hot water bath of about 212° F.

The effects of freezing while in a saturated state were determined showing the expansion while in a frozen state and the permanent set which resulted from this expansion. A number of samples were frozen a second time.

The following table exhibits these results, together with moduli of elasticity and ratios of lateral expansion and longitudinal compression.

When a second freezing had been given the brick, the second values in the column showing the expansion by freezing indicate the total amount of expansion in the gauged length of 6".

BRICK CONTRIBUTED BY THE SOMERSET AND JOHNSONBURG MANUFACTURING COMPANY, BOSTON, MASS.

PAVING BRICK, DARK BROWN COLOR.

No. 1393.

Length, 8".59.

Sectional area, 2".56 × 4".22 = 10.8.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. } E = 3,650,000 pounds per square inch.
1,080	100	0.	0.	
2,160	200	.0001	.....
3,240	300	.0002	.....
4,320	400	.0003	.....
5,400	500	.0004	.....
6,480	600	.0005	.....
7,560	700	.00 6	.....
8,640	800	.0008	.....
9,720	900	.0009	.....
10,800	1,000	.0011	.....
1,080	100	.....	0.
14,200	1,500	.0018	.....
21,600	2,000	.0025	.....
27,000	2,500	.0033	.....
32,400	3,000	.0039	.....
37,800	3,500	.0047	.....
43,200	4,000	.0054	.....
48,600	4,500	.0062	.....
54,000	5,000	.0069	.....
1,080	100	.....	.0002

Lateral expansion under endwise compression loads.

Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,080	100	0.	0.	
54,000	5,000	.0007	.....
1,080	100	.....	0.
54,000	5,000	.0007	.....
1,080	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{3.7}$.

**BRICKS CONTRIBUTED BY THE GAY HEAD CLAY AND BRICK
COMPANY, CHELSEA, MASS.**

FIRE BRICK, "SALAMANDER XX."

No. 1400.

Length, 9".10.

Sectional area, 2".50 × 4".60 = 11.50 square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. } E = 980,000 pounds per square inch.
1, 150	100	0.	0.	
2, 300	200	.0006	.....
3, 450	300	.0011	.....
4, 600	400	.0016	.....
5, 750	500	.0022	.....
6, 900	600	.0028	.....
8, 050	700	.0033	.....
9, 200	800	.0039	.....
10, 350	900	.0044	.....
11, 500	1, 000	.0050	.....
1, 150	100	.....	.0004

Lateral expansion under endwise compression loads.

Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 150	100	0.	0.	
11, 500	1, 000	.0001	.....
1, 150	100	.....	0.
11, 500	1, 000	.0001	.....
1, 150	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{51.7}$.

DARK BUFF SPECKLED BRICK.

No. 1444.

Length, 11".78.

Sectional area, $1''.56 \times 4''.03 = 6.29$ square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compress-ion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
629	100	0.	0.	Initial load. } $E = 2,180,000$ pounds per square inch.
1,258	200	.0004	.....
1,887	300	.0007	.....
2,516	400	.0010	.....
3,145	500	.0012	.....
3,774	600	.0015	.....
4,403	700	.0018	.....
5,032	800	.0021	.....
5,661	900	.0023	.....
6,290	1,000	.0027	.....
629	100	.....	0.
9,435	1,500	.0040	.....
12,580	2,000	.0055	.....
15,725	2,500	.0069	.....
18,870	3,000	.0083	.....
629	100	.....	.0003

Lateral expansion under endwise compression loads.
Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
629	100	0.	0.	Initial load.
18,870	3,000	.0009	.....
629	100	.....	0.
18,870	3,000	.0009	.....
629	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{512}$.

DARK BUFF SPECKLED BRICK.

No. 1445.

Length, 11".75.

Sectional area, 1".55 × 4".03 = 6.25 square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. } E = 2,260,000 pounds per square inch.
625	100	0.	0.	
1,250	200	.0002	-----	
1,875	300	.0006	-----	
2,500	400	.0009	-----	
3,125	500	.0012	-----	
3,750	600	.0014	-----	
4,375	700	.0017	-----	
5,000	800	.0020	-----	
5,625	900	.0022	-----	
6,250	1,000	.0025	-----	
625	100	-----	0.	
9,375	1,500	.0039	-----	
12,500	2,000	.0052	-----	
15,625	2,500	.0065	-----	
18,750	3,000	.0080	-----	
625	100	-----	.0003	

Lateral expansion under end wise compression loads.

Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
625	100	0.	0.	
18,750	3,000	.0006	-----	
625	100	-----	0.	
18,750	3,000	.0006	-----	
625	100	-----	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{75}$.

**BRICK CONTRIBUTED BY THE BLANDFORD BRICK AND TILE
COMPANY, RUSSELL, MASS.**

FIRE BRICK No. 1. X.

No. 1399.

Length, 9".19.

Sectional area, 2".43 × 4".84 = 11.76 square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. } E = 940,000 pounds per square inch.
1, 176	100	0.	0.	
2, 352	200	.0007	.....
3, 528	300	.0013	.....
4, 704	400	.0019	.....
5, 880	500	.0025	.....
7, 056	600	.0031	.....
8, 232	700	.0035	.....
9, 408	800	.0040	.....
10, 584	900	.0046	.....
11, 760	1, 000	.0052	.....
1, 176	100	.....	.0004

Lateral expansion under endwise compression loads.

Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 176	100	0.	0.	
11, 760	1, 000	.0004	.....
1, 176	100	.....	0.
11, 760	1, 000	.0004	.....
1, 176	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{814}$.

**BRICK CONTRIBUTED BY THE NEW ENGLAND STEAM BRICK
COMPANY, PROVIDENCE, R. I.**

PAVING BRICK, DARK RED COLOR.

No. 1395.

Length, 7".75.

Sectional area, 2".35 × 3".55 = 8.34 square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
834	100	0.	0.	
4, 170	500	.0002	.....
8, 340	1, 000	.0007	.....
12, 510	1, 500	.0014	.....
16, 680	2, 000	.0020	.....
20, 850	2, 500	.0026	.....
25, 020	3, 000	.0032	.....
29, 190	3, 500	.0039	.....
33, 360	4, 000	.0045	.....
37, 530	4, 500	.0050	.....
41, 700	5, 000	.0056	.....
834	1000002	E = 4,540,000 pounds per square inch.

Lateral expansion under endwise compression loads.

Transverse gauged length, 3".

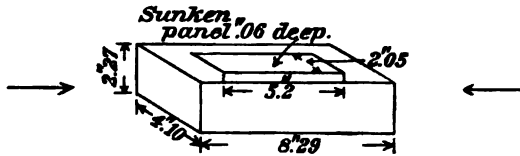
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
834	100	0.	0.	
41, 700	5, 000	.0004	.....
834	100	.....	0.
41, 700	5, 000	.0004	.....
834	100	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{81}$.

BRICKS CONTRIBUTED BY THE SAYRE & FISHER COMPANY,
SAYREVILLE, N. J.

CREAM-COLORED BRICK No. 3.

No. 1397.



Sectional area $(2'' .27 \times 4'' .10) - (.06 \times 2'' .05) = 9.18$ square inches.
Gauged length 5'', on opposite side to sunken panel.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
918	100	0.	0.	Initial load.
1,836	200	.0004	.....
2,754	300	.0007	.....
3,672	400	.0010	.....
4,590	500	.0012	.....
5,508	600	.0014	.....
6,426	700	.0016	.....
7,344	800	.0018	.....
8,262	900	.0021	.....
9,180	1,000	.0023	.....
918	100	.....	.0002
13,770	1,500	.0034	.....
18,380	2,000	.0045	.....
22,950	2,500	.0056	.....
27,540	3,000	.0068	.....
32,130	3,500	.0080	.....
35,600	3,878	Cracks. Ultimate strength.
38,580	4,208	.....	.....

BRICK No. 47.

No. 1446.

Length, 11.79.

Sectional area, $1''.58 \times 3''.96 = 6.26$ square inches.

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Persquare inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
626	100	0.	0.	Initial load. } E = 1,790,000 pounds per square inch.
1,252	200	.0000	.....
1,878	300	.0002	.....
2,504	400	.0004	.....
3,130	500	.0007	.....
3,756	600	.0010	.....
4,382	700	.0013	.....
5,008	800	.0016	.....
5,634	900	.0019	.....
6,260	1,000	.0023	.....
626	100	.....	0.
9,390	1,500	.0039	.....
12,520	2,000	.0057	.....
15,650	2,500	.0078	.....
18,780	3,000	.0105	.....
626	100	.....	.0008
18,780	3,000	.0109	.....
626	100	.....	.0009

Lateral expansion under endwise compression loads.

Transverse gauged length, 3''.5.

Applied loads.		In gauged length.		Remarks.
Total.	Persquare inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
626	100	0.	0.	Initial load.
18,780	3,000	.0029	.....
626	100	.....	.0001
18,780	3,000	.0033	.....
626	1000003	

Brick began to crack in that part covered by the micrometer.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{13}$.

BRICK No. 44.

No. 1447.

Length, 11".88.

Sectional area, 1".55 × 3".97 = 6.15 square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. } E = 2,760,000 pounds per square inch.
615	100	0.	0.	
1,230	200	.0002	.....
1,845	300	.0003	.....
2,460	400	.0005	.....
3,075	500	.0007	.....
3,690	600	.0010	.....
4,305	700	.0012	.....
4,920	800	.0014	.....
5,535	900	.0016	.....
6,150	1,000	.0019	.....
615	100	.....	.0001
9,225	1,500	.0031	.....
12,300	2,000	.0043	.....
15,375	2,500	.0054	.....
18,450	3,000	.0066	.....
615	100	.....	.0003

Lateral expansion under endwise compression loads.
Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
615	100	0.	0.	
18,450	3,000	.0005	.....
615	100	.....	0.
18,450	3,000	.0005	.....
615	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.3}$.

BRICK No. 30.

No. 1448.

Length, 11".93.

Sectional area, $1".51 \times 4".06 = 6.13$ square inches.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
613	100	0.	0.	Initial load. } E = 1,960,000 pounds per square inch.
1,226	200	.0002	.....
1,839	300	.0005	.....
2,452	400	.0008	.....
3,065	500	.0012	.....
3,678	600	.0015	.....
4,291	700	.0018	.....
4,904	800	.0021	.....
5,517	900	.0025	.....
6,130	1,000	.0028	.....
613	100	.....	.0002
9,195	1,500	.0044	.....
12,260	2,000	.0062	.....
613	100	.....	.0004

Lateral expansion under endwise compression loads.
Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
613	100	0.	0.	Initial load.
12,290	2,000	.0005	.....
613	100	.....	0.
12,290	2,000	.0005	.....
613	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{67}$.

BRICKS CONTRIBUTED BY THE FRANKLIN PAVING BRICK COMPANY,
FRANKLIN, PA.

PAVING BRICK, DARK RED COLOR.

No. 1391.

Length, 8".22.

Sectional area, 2".50 x 4".15 = 10.38 square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 038	100	0.	0.	
2, 076	200	.0001	.....
3, 114	300	.0002	.....
4, 152	400	.0004	.....
5, 190	500	.0005	.....
6, 228	600	.0006	.....
7, 266	700	.0007	.....
8, 304	800	.0008	.....
9, 342	900	.0009	.....
10, 380	1, 000	.0010	.....
1, 038	100	.....	0.
15, 570	1, 500	.0014	.....
20, 760	2, 000	.0017	.....
25, 950	2, 500	.0021	.....
31, 140	3, 000	.0025	.....
36, 330	3, 500	.0030	.....
41, 520	4, 000	.0034	.....
46, 710	4, 500	.0037	.....
51, 900	5, 000	.0041	.....
1, 038	100	.....	.0001
62, 280	6, 000	.0048	.....
72, 660	7, 000	.0056	.....
83, 040	8, 000	.0064	.....
93, 420	9, 000	.0071	.....
103, 800	10, 000	.0080	.....
88, 040	8, 000	.0065	.....
62, 280	6, 000	.0050	.....
41, 520	4, 000	.0035	.....
20, 760	2, 000	.0020	.....
10, 380	1, 000	.0011	.....
1, 038	100	.....	.0002

E = 6,350,000 pounds per square inch.

Lateral expansion under endwise compression loads.
Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 038	100	0.	0.	
103, 800	10, 000	.0008	.....
1, 038	100	.....	0.
103, 800	10, 000	.0008	.....
1, 038	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{8}$.

PAVING BRICK, DARK BROWN COLOR.

No. 1392.

Length, 8".14.

Sectional area, 2".46 × 4".18 = 10.28 square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,028	100	0.	0.	
2,056	200	.0001	.....
3,084	300	.0002	.....
4,112	400	.0003	.....
5,140	500	.0004	.....
6,168	600	.0005	.....
7,196	700	.0006	.....
8,224	800	.0006	.....
9,252	900	.0007	.....
10,280	1,000	.0008	.....
1,028	100	.....	0.
15,420	1,500	.0012	.....
20,560	2,000	.0015	.....
25,700	2,500	.0019	.....
30,840	3,000	.0023	.....
35,980	3,500	.0026	.....
41,120	4,000	.0029	.....
46,260	4,500	.0033	.....
51,400	5,000	.0036	.....
1,028	100	.....	0.
61,680	6,000	.0043	.....
71,960	7,000	.0049	.....
82,240	8,000	.0057	.....
92,520	9,000	.0064	.....
102,800	10,000	.0071	.....
1,028	100	.....	.0001

E = 7,070,000 pounds per square inch.

Lateral expansion under endwise compression loads.

Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,028	100	0.	0.	
102,800	10,000	.0008	.....
1,028	100	.....	0.
102,800	10,000	.0008	.....
1,028	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{11}$.

BRICK CONTRIBUTED BY THE POWHATAN CLAY MANUFACTURING COMPANY, RICHMOND, VA.

CREAM-WHITE COLORED BRICK.

No. 1443.

Length, 11".66.

Sectional area, 2".39 x 3".79 = 9.06 square inches.

Gauged length, 10".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
906	100	0.	0.	
1,812	200	.0004	.....
2,718	300	.0007	.....
3,624	400	.0011	.....
4,530	500	.0015	.....
5,436	600	.0019	.....
6,342	700	.0024	.....
7,248	800	.0028	.....
8,154	900	.0032	.....
9,060	1,000	.0036	.....
906	100	.....	.0008
13,590	1,500	.0058	.....
18,120	2,000	.0080	.....
22,650	2,500	.0101	.....
27,180	3,000	.0123	.....
906	100	.....	.0006

} E = 2,480,000 pounds per square inch.

Lateral expansion under endwise compression loads.

Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
906	100	0.	0.	
27,180	3,000	.0006	.....
906	100	.....	0.
27,180	3,000	.0006	.....
906	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{871}$.

BRICK CONTRIBUTED BY JOHN EHARKER, ASHBY, ALA.

FIRE BRICK.

No. 1398.

Length, 9".04.

Sectional area, 2".60 × 4".28 = 11.13 square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. } E = 820,000 pounds per square inch.
1, 113	100	0.	0.	
2, 226	200	.0007	.....
3, 339	300	.0013	.....
4, 452	400	.0021	.....
5, 565	500	.0028	.....
6, 678	600	.0035	.....
7, 791	700	.0041	.....
8, 904	800	.0047	.....
10, 017	900	.0054	.....
11, 130	1, 000	.0061	.....
1, 113	100	.....	.0006
12, 243	1, 100	.0069	.....
13, 356	1, 200	.0075	.....
14, 469	1, 300	.0081	.....
15, 582	1, 400	.0087	.....
16, 695	1, 500	.0095	.....
1, 113	100	.....	.0010

Lateral expansion under endwise compression loads.
Transverse gauged length, 3".5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 113	100	0.	0.	
16, 695	1, 500	.0006	.....
1, 113	100	.....	0.
16, 695	1, 500	.0006	.....
1, 113	100	.....	.0001

Ratio of lateral expansion to longitudinal compression, $\frac{1}{10.3}$.

BRICK CONTRIBUTED BY THE A. O. JONES BRICK AND TERRA COTTA COMPANY, ZANESVILLE, OHIO.

PAVING BRICK, DARK BROWN COLORED

No. 1394.

Length, 7".89.

Sectional area, 2".58 × 3".89 = 10.04 square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,004	100	0.	0.	
2,008	200	.0001	.....
3,012	300	.0004	.....
4,016	400	.0006	.....
5,020	500	.0008	.....
6,024	600	.0010	.....
7,028	700	.0011	.....
8,032	800	.0012	.....
9,036	900	.0013	.....
10,040	1,000	.0014	.....
1,004	100	.....	0.
15,060	1,500	.0020	.....
20,080	2,000	.0025	.....
25,100	2,500	.0031	.....
30,120	3,000	.0036	.....
35,140	3,500	.0041	.....
40,160	4,000	.0045	.....
45,180	4,500	.0050	.....
50,200	5,000	.0056	.....
1,004	100	.....	0.
55,220	5,500	.0061	.....
60,240	6,000	.0066	.....
1,004	100	.....	.0001

E = 4,540,000 pounds per square inch.

Lateral expansion under endwise compression loads.
Transverse gauged length, 3".5.

Applied loads		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,004	100	0.	0.	
60,240	6,000	.0008	.....
1,004	100	.....	0.
60,240	6,000	.0008	.....
1,004	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{876}$.

**BRICK CONTRIBUTED BY THE KELLEY BRICK AND TILE COMPANY,
MINNEAPOLIS, MINN.**

LIGHT BUFF COLORED BRICK.

No. 1396.

Length, 7".64.

Sectional area, 2".36 × 3".68 = 8.68 square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. } E = 2,500,000 pounds per square inch.
868	100	0.	0.	
1,736	200	.0002	.....
2,604	300	.0004	.....
3,472	400	.0006	.....
4,340	500	.0008	.....
5,208	600	.0010	.....
6,076	700	.0012	.....
6,944	800	.0014	.....
7,812	900	.0016	.....
8,680	1,000	.0018	.....
868	100	.....	0.
13,020	1,500	.0027	.....
17,360	2,000	.0037	.....
21,700	2,500	.0048	.....
26,040	3,000	.0057	.....
30,380	3,500	.0068	.....
34,720	4,000	.0078	.....
39,060	4,500	.0089	.....
43,400	5,000	.0100	.....
868	100	.....	.0002

Lateral expansion under endwise compression loads.
Transverse gauged length, 3".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
868	100	0.	0.	
43,400	5,000	.0012	.....
868	100	.....	0.
43,400	5,000	.0012	.....
868	100	.....	0.

Ratio of lateral expansion to longitudinal compression, $\frac{1}{40}$.

BRICKS CONTRIBUTED BY GLADDING, McBEAN & Co., SAN FRANCISCO, CAL.

FRONT PRESSED BRICK, SEMI-DRY MACHINE, HARD BURNT, BUFF COLOR.

No. 1387.

Length, 8".17.

Sectional area, $2''.43 \times 4''.10 = 9.96$ square inches.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
996	100	0.	0.	Initial load.
1,992	200	.0008	.....
2,988	300	.0016	.....
3,984	400	.0024	.....
4,980	500	.0032	.....
5,976	600	.0042	.....
6,972	700	.0055	.....
7,968	800	.0073	.....
8,964	900	.0100	.....
9,280	932	.....	.....		Ultimate strength.

FRONT PRESSED BRICK, STIFF MUD MACHINE, SOFT BURNT, CREAM COLOR.

No. 1388.

Length, 8".40.

Sectional area, $2''.36 \times 4''.22 = 9''.96$.

Gauged length, 5".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
996	100	0.	0.	Initial load.
1,992	200	.0008	.....
2,988	300	.0016	.....
3,984	400	.0024	.....
4,980	500	.0032	.....
5,976	600	.0042	.....
6,972	700	.0055	.....
7,968	800	.0073	.....
8,964	900	.0100	.....
9,960	1,000	.0020	.....
996	100	0.	} E = 2,500,000 pounds per square inch.
14,940	1,500	.0030	.....
19,920	2,000	.0040	.....
996	100	.....	.0002
24,900	2,500	.0050	.....
29,880	3,000	.0059	.....
996	100	.....	.0002
34,860	3,500	.0070	.....
39,840	4,000	.0081	.....
44,820	4,500	.0092	.....
49,800	5,000	.0103	.....
996	100	.....	.0004

Lateral expansion under endwise compression loads.

Transverse gauged length, 3'' .5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
996	100	0.	0.	Initial load.
49,800	5,000	.0012	0.	
996	100	.....	0.
49,800	5,000	.0012	0.	
996	100	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{57}$.

FIRE BRICK, LIGHT BUFF COLOR.

No. 1389.

Length, 9'' .04.

Sectional area, 2'' .46 \times 4'' .51 = 11.09 square inches.

Gauged length, 5'' .

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,109	100	0.	0.	Initial load.
2,218	200	.0001	.....
3,327	300	.0003	.....
4,436	400	.0005	.....
5,545	500	.0007	.....
6,654	600	.0009	.....
7,763	700	.0012	.....
8,872	800	.0014	.....
9,981	900	.0016	.....
11,090	1,000	.0018	.....
1,109	100	.....	.0001
16,635	1,500	.0028	.....
22,180	2,000	.0039	.....
1,109	100	.....	.0002
27,725	2,500	.0051	.....
33,270	3,000	.0065	.....
1,109	100	.....	.0005

} E = 2,420,000 pounds per square inch.

Lateral expansion under endwise compression loads.
Transverse gauged length, 3'' .5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,109	100	0.	0.	Initial load.
33,270	3,000	.0007	.....
1,109	100	.....	0.
33,270	3,000	.0007	.....
1,109	1000001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{87}$.

EXPANSION OF BRICKS.

TABLE SHOWING THE EFFECT OF TREATMENT OF BRICKS IN WATER AND AIR AT DIFFERENT TEMPERATURES.

Contributor.	Description.	Treatment.	Temperature.	Gauged length.	Coefficient of expansion.			
			°F.	Inches.	Inch.			
Kansas City Hydraulic Press Brick Co., Kansas City, Mo.	Red brick No. 1	Open air	68	5.9967	} 00000326			
		In water bath 8 days	66½	5.9974				
		In cold water	33	5.9967				
		In hot water	212	6.0006				
		In cold water	33	5.9971				
		Removed from cold water, and while saturated with water placed out of doors over night and frozen	25	5.9980				
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	5.9969				
		Removed from cold bath and frozen second time	28	5.9979				
		Do	Red brick No. 2	Open air		68	5.9997	} 00000317
				In water bath 8 days		66½	6.0000	
In cold water	33			5.9995				
In hot water	212			6.0086				
In cold water	33			6.0002				
Removed from cold bath and while saturated with water placed out of doors over night and frozen	25			6.0010				
Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33			6.0000				
Removed from cold bath and frozen second time	28			6.0013				
Powhatan Clay Manufacturing Co., Richmond, Va.	Cream white, No. 1.			Open air	68	5.9996	} 00000205	
				In water bath 8 days	66½	6.0000		
		In cold water	33	5.9998				
		In hot water	212	6.0021				
		In cold water	33	5.9999				
		Removed from cold water, and while saturated with water placed out of doors over night and frozen	25	6.0024				
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0004				
		Removed from cold bath and frozen second time	28	6.0029				
		Do	Dark red, No. 2.	Open air	68	6.0002		} 00000289
				In water bath 8 days	66½	6.0002		
In cold water	33			5.9996				
In hot water	212			6.0037				
In cold water	33			6.0006				
Removed from cold water, and while saturated with water placed out of doors over night and frozen	25			6.0015				
Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33			6.0004				
Removed from cold bath and frozen second time	28			6.0010				
The Hydraulic Press Brick Co., St. Louis, Mo.	Medium red ..			Open air	68	5.9997	} 00000317	
				In water bath 8 days	66½	5.9997		
		In cold water	33	5.9989				
		In hot water	212	6.0031				
		In cold water	33	5.9997				
		Removed from cold water, and while saturated with water placed out of doors over night and frozen	25	6.0014				
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0000				
		Removed from cold bath and frozen second time	28	6.0017				

Treatment of bricks in water and air at different temperatures—Continued.

Contributor.	Description.	Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
			°F.	Inches.	Inch.
The Hydraulic Press Brick Co., St. Louis, Mo.	Light chocolate.	Open air.....	67	6.0005	0.0000475
		In water bath 8 days.....	66½	6.0002	
		In cold water.....	33	5.9985	
		In hot water.....	212	6.0056	
		In cold water.....	33	6.0005	
		Removed from cold bath and frozen in open air.....			
		In water bath 2 months; temperature, 65° F.; then in cold water 12 hours.....	26	6.0060	
			33	6.0029	
			67	6.0015	
			66½	6.0020	
Do.....	Dark buff speckled.	In cold water.....	33	6.0012	0.0000391
		In hot water.....	212	6.0060	
		In cold water.....	33	6.0018	
		Removed from cold bath and frozen in open air.....			
		In water bath 2 months; temperature, 65° F.; then in cold water 12 hours.....	26	6.0041	
			33	6.0030	
			68	6.0015	
			66½	6.0017	
			33	6.0012	
			212	6.0058	
Philadelphia and Boston Face Brick Co., Boston, Mass.	Salmon colored.	In cold water.....	33	6.0022	0.0000385
		In hot water.....	212	6.0058	
		In cold water.....	33	6.0022	
		Removed from cold bath and while saturated with water placed out of doors over night and frozen.....			
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath.....	25	6.0065	
		Removed from cold bath and frozen second time.....	33	6.0032	
			28	6.0088	
			68	5.9975	
			66½	5.9979	
			33	5.9974	
Do.....	Salmon colored.	In hot water.....	212	6.0018	0.0000261
		In cold water.....	33	5.9990	
		Removed from cold bath and while saturated with water placed out of doors over night and frozen.....			
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath.....	25	6.0018	
		Removed from cold bath and frozed second time.....	33	6.0000	
			28	6.0080	
			67	5.9953	
			66½	5.9956	
			33	5.9952	
			212	5.9952	
Do.....	Chocolate brown.	In cold water.....	33	5.9953	0.0000298
		In hot water.....	212	5.9953	
		In cold water.....	33	5.9953	
		Removed from cold bath and frozen in open air.....			
		In water bath 2 months, temperature 65° F., then in cold bath 12 hours.....	26	5.9978	
			33	5.9962	
			67	5.9972	
			66½	5.9975	
			33	5.9967	
			212	6.0006	
Do.....	Cream color.....	In cold water.....	33	5.9979	0.0000252
		In hot water.....	212	6.0006	
		In cold water.....	33	5.9979	
		Removed from cold bath and frozen in open air.....			
		In water bath 2 months, temperature 65° F., then in cold bath 12 hours.....	26	6.0037	
			33	6.0004	
			67	6.0041	
			66½	6.0044	
			33	6.0038	
			212	6.0061	
Do.....	Buff color.....	In cold water.....	33	6.0049	0.0000238
		In hot water.....	212	6.0061	
		In cold water.....	33	6.0049	
		Removed from cold bath and frozen in open air.....			
		In water bath 2 months, temperature 65° F., then in cold bath 12 hours.....	26	6.0102	
			33	6.0075	
			67	6.0041	
			66½	6.0044	
			33	6.0038	
			212	6.0061	
	33	6.0049			

Treatment of bricks in water and air at different temperatures—Continued.

Contributor.	Description.	Treatment.	Temper- ature.	Gauged	Coefficient of expan- sion.			
				length.				
			°F.	Inches.	Inch.			
Eastern Hydraulic Press Brick Co., Philadelphia, Pa.	Shade 200	Open air	68	5.9889	} 00000345			
		In water bath 8 days	60½	5.9994				
		In cold water	33	5.9885				
		In hot water	212	6.0029				
		In cold water	33	5.9992				
		Removed from cold bath, and while saturated with water placed out of doors over night and frozen	25	6.0320				
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0003				
		Removed from cold bath and frozen second time	28	6.0029				
		Do	Shade 300	Open air		68	6.0003	} 00000344
				In water bath 8 days		66½	6.0007	
In cold water	33			6.0001				
In hot water	212			6.0046				
In cold water	33			6.0009				
Removed from cold bath and frozen in open air	26			6.0037				
In water bath 2 months, temper- ature 65° F., then in cold bath 12 hours	33			6.0019				
Do	Shade 410			Open air	67	6.0023	} 00000568	
				In water bath 8 days	66½	6.0031		
				In cold water	33	6.0017		
		In hot water	212	6.0085				
		In cold water	33	6.0024				
		Removed from cold bath and frozen in open air	26	6.0043				
		Brooke Terra Cotta Co., Lazeurville W. Va.	Columbian buff, No. 4	Open air	68	6.0004		} 00000242
				In water bath 8 days	66½	6.0003		
				In cold water	33	5.9991		
				In hot water	212	6.0024		
In cold water	33			5.9998				
Removed from cold bath, and while saturated with water placed out of doors over night and frozen	25			6.0040				
Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33			6.0012				
Removed from cold bath and frozen second time	28			6.0070				
Do	Light buff			Open air	67	5.9903	} 00000205	
				In water bath 8 days	66½	5.9997		
		In cold water	33	5.9905				
		In hot water	212	6.0020				
		In cold water	33	5.9998				
		Removed from cold bath and frozen in open air	26	6.0015				
		In water bath at 65° F. 2 months, then in cold bath 12 hours	33	5.9997				
		Gladding McBean & Co., San Francisco, Cal.	Dark buff, hard burnt.	Open air	67	6.0026		} 00000419
				In water bath 8 days	66½	6.0032		
				In cold water	33	6.0021		
In hot water	212			6.0068				
In cold water	33			6.0023				
Removed from cold bath, and while saturated with water placed out of doors over night and frozen	25			6.0037				
Placed in water bath at 65° F. 6 hours while frozen, then placed in cold bath	33			6.0026				
Removed from cold bath and frozen second time	28			6.0045				
Do	Salmon, soft burnt.			Open air	67	6.0028	} 00000428	
				In water bath 8 days	66½	6.0032		
		In cold water	33	6.0024				
		In hot water	212	6.0076				
		In cold water	33	6.0030				
		Removed from cold bath and frozen in open air	26	6.0092				

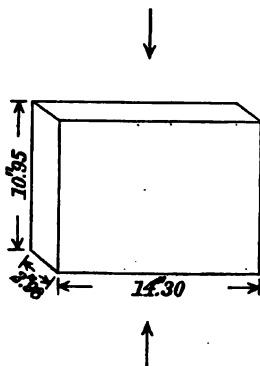
Treatment of bricks in water and air at different temperatures—Continued.

Contributor.	Description.	Treatment.	Temperature.	Gauged length.	Coefficient of expansion.			
			°F.	Inches.	Inch.			
Northern Hydraulic Press Brick Co., Minneapolis, Minn.	Red brick.....	Open air	67	6.0005	} 0000316			
		In water bath 8 days	66½	6.0008				
		In cold water	33	6.0002				
		In hot water	212	6.0040				
		In cold water	33	6.0006				
		Removed from cold bath, and while saturated with water placed out of doors over night and frozen	25	6.0012				
		Placed in water bath at 65°F. while frozen, 6 hours, then placed in cold bath	38	6.0005				
		Removed from cold bath and frozen second time	28	6.0016				
		Chicago Hydraulic Press Brick Co., Chicago, Ill.do	Open air		67	6.0007	} 0000344
				In water bath 8 days		66½	6.0010	
In cold water	33			6.0001				
In hot water	212			6.0045				
In cold water	33			6.0008				
Removed from cold bath and frozen in open air	26			6.0042				
Clark Pressed Brick Co., Malvern, Ark.	Chocolate.....	Open air	67	6.0039	} 0000744			
		In water bath 8 days	66½	6.0041				
		In cold water	33	6.0083				
		In hot water	212	6.0125				
		In cold water	33	6.0045				
		In hot water	212	6.0128				
		In cold water	32	6.0047				
		In water bath 2 months, temperature 65°F., then in cold bath 12 hours	33	6.0050				
		Taken from cold bath and exposed out of doors over night.....	28 to 30	6.0098				

BRICKS.
TABULATION OF COMPRESSIVE MODULI OF ELASTICITY, LATERAL EXPANSION UNDER ENDWISE COMPRESSION, COEFFICIENTS OF EXPANSION, AND EXPANSION DUE TO FREEZING WHILE SATURATED WITH WATER, ALSO ABSORPTION OF WATER.

No. of test pieces.	Contributor.	Description.	Modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Total absorption after exposure to boiling water, by volume.	Coefficient of expansion.	Expansion by freezing, in 6 inches.	Permanence after freezing, in 6 inches.
			Pounds.	r ₁ :	Per cent.	Inch.	Inch.	Inch.
1373	Kansas City Hydraulic Press Brick Co., Kansas City, Mo.	Red brick No. 1	1,650,000	r ₁ :	28.8	.00000228	.0009	.0002
1374	do	Red brick No. 2	2,130,000	r ₁ :	25.1	.00000317	.0008	.0002
1378	The Powhatan Clay Manufacturing Co., Richmond, Va.	Cream white No. 1	1,790,000	r ₁ :	28.7	.00000295	.0025	.0005
1377	do	Dark red No. 2	8,180,000	r ₁ :	18	.00000289	.0009	.0002
1370	The Hydraulic Press Brick Co., St. Louis, Mo.	Medium red	714,000	r ₁ :	32	.00000317	.0017	.0003
1371	do	Light chocolate	2,550,000	r ₁ :	23.2	.00000475	.0055	.0024
1372	do	Dark buff speckled	890,000	r ₁ :	23.7	.00000391	.0023	.0012
1381	Philadelphia and Boston Face Brick Co., Boston, Mass.	Salmon color, soft burnt, for inside work	391,000	r ₁ :	36.2	.00000335	.0043	.0010
1382	do	do	517,000	r ₁ :	34	.00000261	.0028	.0010
1386	do	Chocolate brown, for outside work	5,000,000	‡	13.6	.00000298	.0025	.0009
1384	do	Cream color, for outside work	577,000	r ₁ :	35.3	.00000252	.0055	.0025
1385	do	Buff color, for outside work	2,570,000	r ₁ :	24.8	.00000288	.0053	.0026
1395	Eastern Hydraulic Press Brick Co., Philadelphia, Pa.	Shade 200	2,120,000	r ₁ :	17.8	.00000345	.0028	.0011
1366	do	Shade 300	2,050,000	‡	18.7	.00000344	.0028	.0010
1367	do	Shade 410	2,170,000	r ₁ :	17.4	.00000568	.0019	.0010
1375	Brooke Terra Cotta Co., Leesville, W. Va.	Columbian buff No. 4	4,000,000	r ₁ :	21.8	.00000242	.0042	.0014
1376	do	Light buff	4,820,000	r ₁ :	16.9	.00000295	.0017	.0001
1380	Gladding, McBean & Co., San Francisco, Cal.	Dark buff, hard burnt	4,450,000	r ₁ :	26.3	.00000419	.0032	.0003
1379	do	Salmon, soft burnt	2,290,000	r ₁ :	21.3	.00000428	.0046	.0001
1364	Northern Hydraulic Press Brick Co., Minneapolis, Minn.	Red brick	1,940,000	‡	29.2	.00000316	.0010	.0001
1368	Chicago Hydraulic Press Brick Co., Chicago, Ill.	do	1,410,000	‡	22	.00000344	.0034	.0001
1363	Clark Press Brick Co., Malvern, Ark.	Chocolate	1,520,000	‡	24.1	.00000754	.0048	.0001

No. 8368.

**COMPRESSION OF BUILDING BLOCK FURNISHED BY JOHN COOK,
AVON PARK, DE SOTO COUNTY, FLORIDA.**

Compressed surfaces faced with plaster of Paris to secure even bearings in the testing machine.

Sectional area, $14'' .30 \times 2'' .98 = 42.61$ square inches.

First crack at 19,980 pounds.

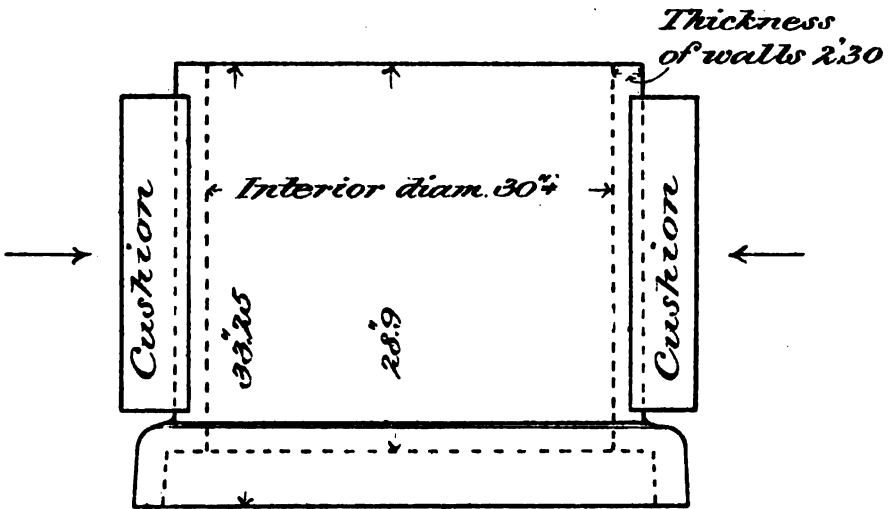
Ultimate strength 19,980 pounds = 469 pounds per square inch.

COMPRESSION TESTS OF CULVERT PIPE.

MATERIAL FURNISHED BY THE PORTLAND STONE-
WARE COMPANY, PORTLAND, ME.



30-inch Culvert pipe

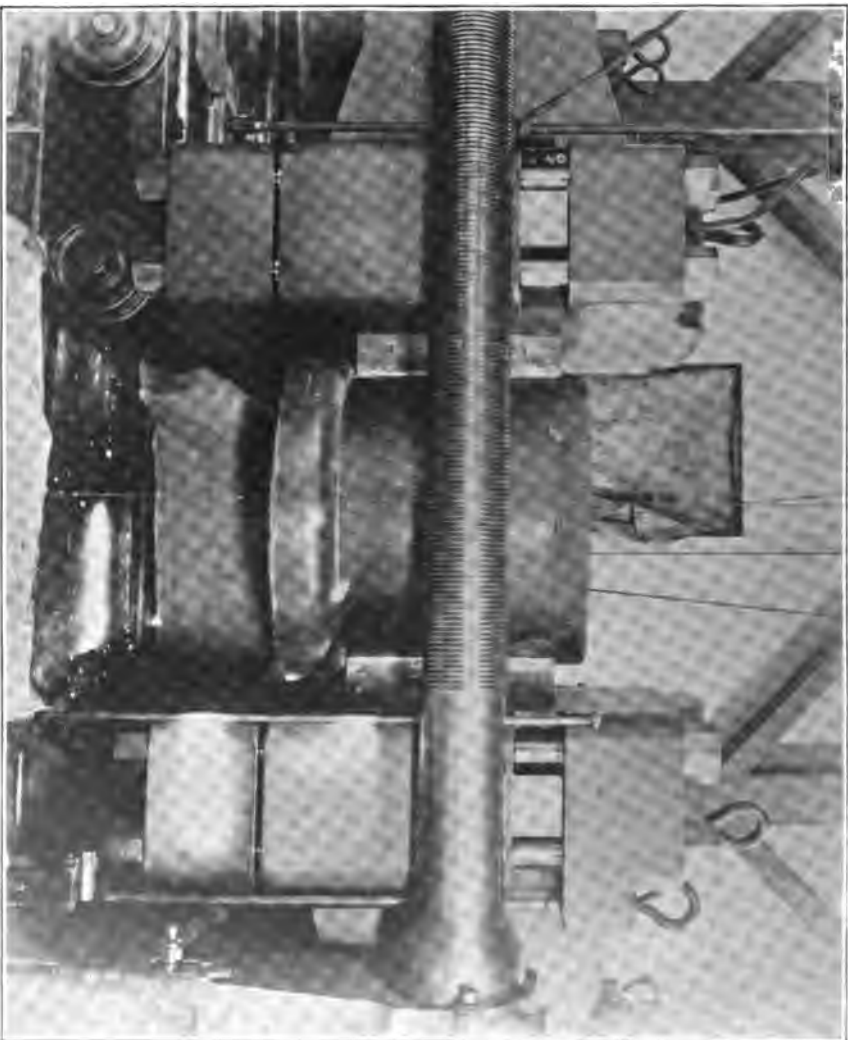


The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry, no matter how small, should be recorded to ensure the integrity of the financial statements. This includes not only sales and purchases but also expenses and income.

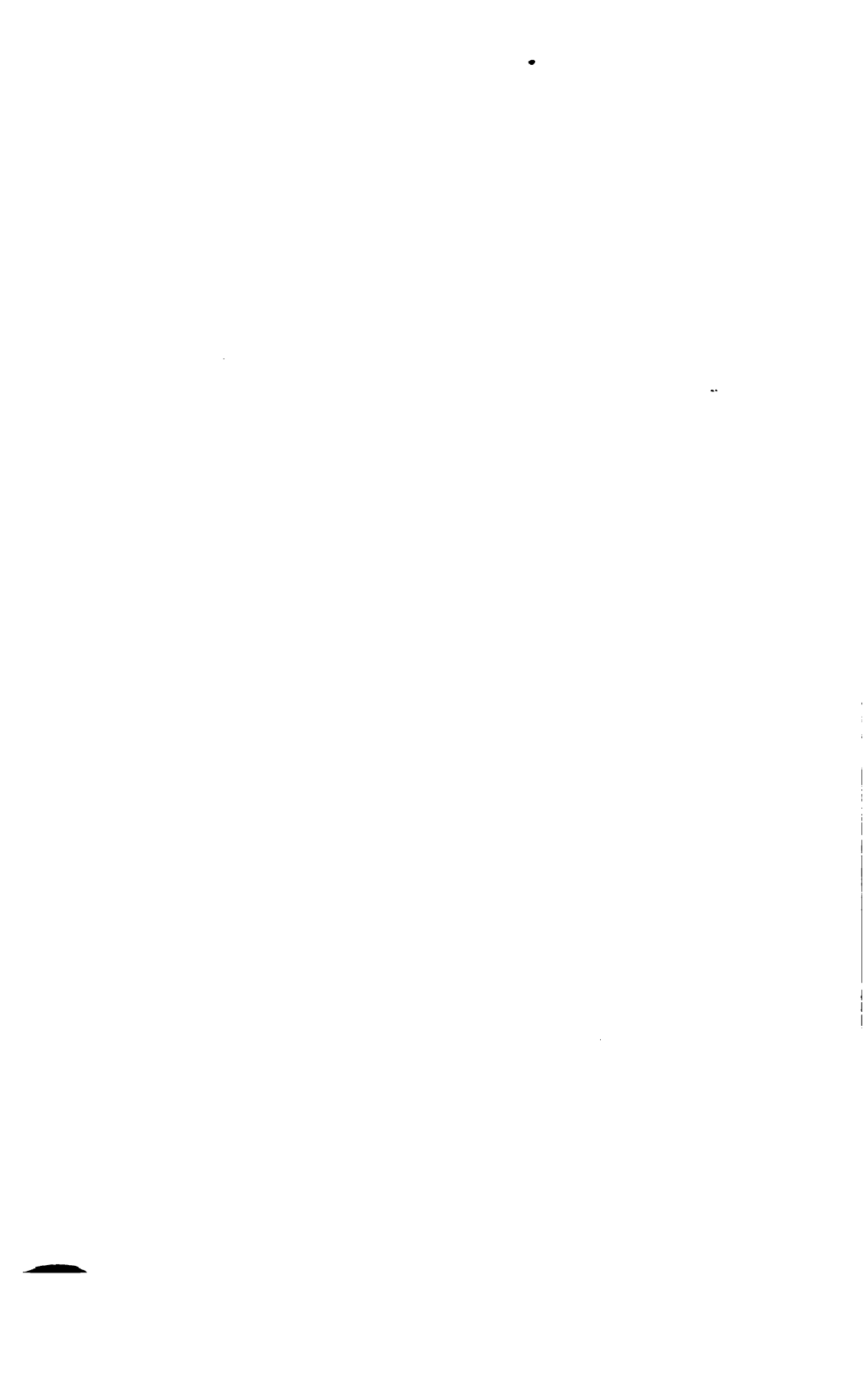
The second part of the document provides a detailed breakdown of the company's assets and liabilities. It lists the various types of assets, such as cash, accounts receivable, and inventory, and provides a clear explanation of how each is valued. Similarly, it details the company's liabilities, including accounts payable and long-term debt, and explains the methods used to determine their values.

The third part of the document focuses on the company's income statement. It shows the total revenue generated during the period, minus the cost of goods sold, resulting in the gross profit. It then breaks down the operating expenses, such as salaries, rent, and utilities, and shows how they are deducted from the gross profit to arrive at the net income.

Finally, the document concludes with a summary of the company's overall financial performance. It highlights the key trends and provides a clear picture of the company's financial health. It also includes a brief discussion of the company's future prospects and the challenges it faces.



PHOTOGRAPH SHOWING 30-INCH CULVERT PIPE IN POSITION IN THE TESTING MACHINE, AFTER THE TEST.



COMPRESSION TESTS OF CULVERT PIPE.

Tested between hard-wood cushions fitted to diameter of pipe, and covering approximately one-third the exterior diameter.

Samples branded "Portland Double Strength Culvert Pipe."

30-inch culvert pipe.

Length over all.....	inches..	33.25
Interior diameter.....	do....	30 $\frac{1}{2}$
Thickness of walls.....	do....	2.30
Weight.....	pounds..	625

Dimensions of cushions: Length, 23'' $\frac{6}{10}$; width, 11 $\frac{1}{2}$ ''.

Ultimate strength, 8,250 pounds.

The pipe failed by the development of longitudinal fractures, which divided the pipe into four principal fragments. Two fractures were developed at sides, or about 90° from the cushions, and two were located at the sides of the cushions.

30-inch culvert pipe.

Length over all.....	inches..	33 $\frac{1}{2}$
Interior diameter.....	do....	30 $\frac{1}{2}$
Thickness of walls.....	do....	2.25
Weight.....	pounds..	627

Dimensions of cushions: Length, 23'' $\frac{6}{10}$; width, 11 $\frac{1}{2}$ ''.

Ultimate strength, 8,890 pounds.

The pipe failed by the development of fractures generally extending lengthwise the specimen.

There were 10 principal fragments.

24-inch culvert pipe.

Length over all.....	inches..	34 $\frac{1}{2}$
Interior diameter.....	do....	24
Thickness of walls.....	do....	2.00
Weight.....	pounds..	443

Dimensions of cushions: Length, 24''; width, 9 $\frac{1}{4}$ ''.

Ultimate strength, 7,120 pounds.

Developed four principal fractures in the plane of diameters, perpendicular and parallel to the direction of loading.

24-inch culvert pipe.

Length over all.....	inches..	34 $\frac{1}{2}$
Interior diameter.....	do....	24
Thickness of walls.....	do....	2.00
Weight.....	pounds..	439

Dimensions of cushions: Length, 24''; width, 9 $\frac{1}{4}$ ''.

Ultimate strength, 7,310 pounds.

Manner of fracture same as first 24-inch sample.

20-inch culvert pipe.

Length over all.....	inches..	33½
Interior diameter.....	do....	20
Thickness of walls.....	do....	1.75
Weight.....	pounds..	316

Dimensions of cushions: Length, 24"; width, 7".7.

Ultimate strength, 7,880 pounds.

Failed by developing longitudinal cracks, one of which was in a plane 90° from the direction of loading, and two were in the plane of loading diametrically opposite.

20-inch culvert pipe.

Length over all.....	inches..	33½
Interior diameter.....	do....	20
Thickness of walls.....	do....	1.70
Weight.....	pounds..	319

Dimensions of cushions: Length, 24"; width, 7".7.

Ultimate strength, 6,020 pounds.

Failure occurred in the same manner as the first 20-inch sample.

18-inch culvert pipe.

Length over all.....	inches..	39½
Interior diameter.....	do....	18
Thickness of walls.....	do....	1.62
Weight.....	pounds..	312

Dimensions of cushions: Length, 23½"; width, 7".25.

Ultimate strength, 9,180 pounds.

Failed by developing longitudinal cracks in the plane of loading and at right angles thereto.

The cracks first visible were those in the plane of loading.

18-inch culvert pipe.

Length over all.....	inches..	39½
Interior diameter.....	do....	18
Thickness of walls.....	do....	1.61
Weight.....	pounds..	316

Dimensions of cushions: Length, 23½"; width, 7".25.

Ultimate strength, 10,010 pounds.

Manner of failure similar to the first 18-inch sample.

15-inch culvert pipe.

Length over all.....	inches..	39½
Interior diameter.....	do....	15
Thickness of walls.....	do....	1.46
Weight.....	pounds..	234

Dimensions of cushions: Length, 24"; width, 5".8.

Ultimate strength, 7,980 pounds.

Failed by developing longitudinal seams in the plane of loading and at right angles to the same.

15-inch culvert pipe.

Length over all.....	inches..	40
Interior diameter.....	do.....	15
Weight.....	pounds..	237

Dimensions of cushions: Length, 24"; width 5".8.

Ultimate strength, 7,250 pounds.

Failure occurred in the same manner as the first 15-inch sample.

12-inch culvert pipe.

Length over all.....	inches..	38½
Interior diameter.....	do.....	12
Thickness of walls.....	do.....	1.37
Weight.....	pounds..	181

Dimensions of cushions: Length, 24"; width, 4⅞".

Ultimate strength, 8,160 pounds.

Developed longitudinal cracks in the plane of the applied loads, after which fractures opened on the sides at right angles to the same.

12-inch culvert pipe.

Length over all.....	inches..	38½
Interior diameter.....	do.....	12
Thickness of walls.....	do.....	1.38
Weight.....	pounds..	180

Dimensions of cushions: Length, 24"; width, 4⅞".

Ultimate strength, 9,090 pounds.

Failed by opening longitudinal cracks.

The crack first visible was along the side at right angles to the plane of loading, which was immediately followed by a crack opening in the plane of loading.



DOUGLAS FIR WOOD

FROM THE

PACIFIC PINE LUMBER COMPANY,
SAN FRANCISCO, CAL.



DOUGLAS FIR WOOD.

The tests comprise observations on the elastic properties of the wood when loaded in different directions, also the compressive strength and tensile strength of a number of samples.

Short blocks were loaded sidewise the grain, the direction of loading with reference to the annual rings of growth being parallel, perpendicular, or oblique in different specimens.

Micrometer observations show the compressibility of the wood in these several directions.

Under the same conditions of loading, the samples from different trees showed a considerable range in compressibility, while in samples from the same tree there was a marked difference in the results when comparing the compressibility in a radial direction, with reference to the tree, with the compressibility taken in a tangential direction, the more rigid condition being found under radial loads.

As the higher loads were reached and general crushing of the fibers occurred, the advantages of radial loading became apparent in the manner of failure of the wood. There was less splitting along the grain than in the case of loads being applied tangentially to the tree. When the loading occurred oblique to the rings of growth, the failure of the sample was accompanied by splitting along the grain, similar to the effects of tangential loads.

Two gauged lengths were established on blocks from stick No. 32 for the purpose of determining both the direct compression and also the lateral expansion of the wood when loaded crosswise the grain.

Full-length sticks were strained by tension up to such total loads as the means of securing the ends by frictional grips permitted. The low crushing strength of wood crosswise the grain necessarily restricts the gripping pressures to comparatively low loads, and thereby restricts the applicable tensile stress.

Both longitudinal extension and lateral contraction observations under tensile stresses were observed.

With sample No. 8544 the lateral contraction was observed on gauged lengths at three places along its length, a progressive difference being shown in the amount of contraction in passing from one end to the other of the stick. A subsequent examination of the longitudinal extension covered by two gauged lengths of 50" each showed the stick extended more at the end displaying the greatest lateral contraction.

Sticks strained by tension were subsequently cut into shorter lengths and then tested by compression. Their elastic properties under compression loads were determined, including both longitudinal compression and lateral expansion.

Specimens were prepared to determine the full tensile strength of the wood, which were made with conical ends, the part fractured being 1" diameter.

Stick No. 26 furnished samples straight grained, which, in one test, reached a strength of 24,137 pounds per square inch.

The other sticks tested generally sheared along the grain. The direction of the grain prevented obtaining satisfactory tensile tests, notwithstanding a second set was taken out and tested.

In the following tables are shown the tensile and compressive moduli of elasticity for loads applied in the direction of the grain and crosswise the same. In the crosswise direction the difference in effect between tangential and radial loads is shown. The ratios of lateral to direct strains are also shown by a table.

MODULI OF ELASTICITY.

Loads applied endwise the grain.

No. of test.	No. of stick.	Modulus of elasticity per square inch.		Remarks.
		Tensile.	Compressive.	
		<i>Pounds.</i>	<i>Pounds.</i>	
8513	26	2,655,000	.....
1449	26	2,662,000	.....
8514	30	1,923,000	3,461,000	Cut from No. 8513.
1450	30	1,929,000	.....
8544	30	1,787,000	2,018,000	Cut from No. 8514.
1451	30	1,763,000	.....
8543	41	1,789,000	1,915,000	Cut from No. 8544.
1452	41	.....	2,036,000	Cut from No. 8543.

Loads applied perpendicular to the grain.

No. of test.	No. of stick.	Modulus of elasticity per square inch—Direction of loading with reference to tree.		Remarks.
		Tangential.	Radial.	
		<i>Pounds.</i>	<i>Pounds.</i>	
1432	2	40,000	.....
1433	2	.....	207,000	
1425	4	75,000	.....
1426	4	.....	162,000	} Same specimen.
1429	4	61,000	.....
1430	4	.....	138,000	
1431	4	77,000	.....
1427	6	37,000	.....	} Loaded obliquely.
1428	6	.....	45,000	
1434	32	112,000	.....
1435	32	.....	152,000	
1436	32	93,000	.....
1437	32	.....	155,000	
1442	32	93,000	.....
1453	32	88,580	134,300	

Ratios of lateral contraction to longitudinal extension, and lateral expansion to longitudinal compression, under tension and compression loads, respectively.

Loads applied endwise the grain.

No. of test.	No. of stick.	Tension loads.	Com-pression loads.	Remarks.
1440	26	<i>Ratio.</i>	<i>Ratio.</i>	} Supplementary tests.
	End A	1.75	1.57	
	Middle	1.75	1.57	
8544	30	1.75	1.57	
	End A	1.75	1.57	
	End B	1.75	1.57	
1450	30	1.75	1.57	
1451	30	1.75	1.57	
1452	41	1.75	1.57	

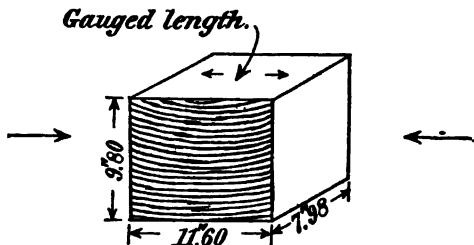
Compression loads applied crosswise the grain.

No. of test.	No. of stick.	Direction of loading with reference to tree.		Remarks.
		Tangential.	Radial.	
1458	32	<i>Ratio.</i>	<i>Ratio.</i>	
1443	32	1.75	1.57	

COMPRESSION TESTS.

No. 1432.

Sample from stick marked 2.
Loaded tangentially, or parallel to the grain.



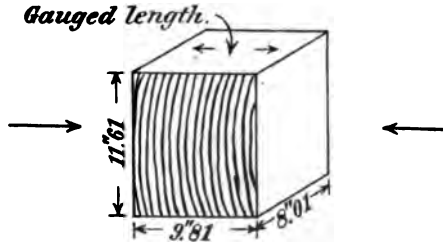
Sectional area, $9'' .80 \times 7'' .98 = 78.2$ square inches.
Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,564	20	0.	0.	Initial load.
3,128	40	.0024		
4,692	60	.0050		
6,256	80	.0085		
7,820	100	.0105		
1,564	20		.0017	
9,384	120	.0128		
10,948	140	.0158		
12,512	160	.0187		
14,076	180	.0220		
15,640	200	.0252		
1,564	20		.0042	
17,204	220	.0285		
18,768	240	.0344		
20,332	260	.0392		
21,896	280	.0441		
23,460	300	.0551		
1,564	20		.0132	} E = 40,000 pounds per square inch.
25,024	320	.0624		
26,588	340	.0757		
28,152	360	.0886		
29,716	380	.1019		
31,280	400	.12		
32,844	420	.18		
34,408	440	.35		
35,972	460	.83		
39,100	500	.150		
47,900	613			Ultimate strength.

Fibers split along the grain.

No. 1433.

Sample from stick marked 2. Taken off at end of sample No. 1432. Loaded radially, or perpendicular to the rings of growth.



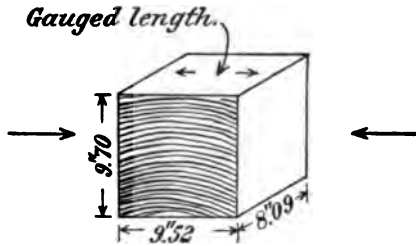
Sectional area, $11''.61 \times 8''.01 = 93$ square inches.
Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
1,880	20	0.	0.	
3,722	40	.0008	} E = 207,000 pounds per square inch.
5,580	60	.0015	.....
7,440	80	.0022	.....
9,300	100	.0028	.....
1,880	20	.....	.0002
11,160	120	.0035	.....
13,020	140	.0040	.....
14,880	160	.0046	.....
16,740	180	.0053	.....
18,600	200	.0058	.....
1,880	20	.....	.0002
20,460	220	.0064	.....
22,320	240	.0070	.....
24,180	260	.0075	.....
26,040	280	.0080	.....
27,900	300	.0085	.....
1,880	20	.....	.0004
29,760	320	.0092	.....
31,620	340	.0099	.....
33,480	360	.0108	.....
35,340	380	.0113	.....
37,200	400	.0220	.....
1,880	20	.....	.0045
39,060	420	.0845	.....
40,920	440	.0522	.....
42,780	460	.09	.....
44,640	480	.27	.....
46,500	500	.48	.....
48,360	520	.80	.....
50,220	540	1.10	.....
52,080	560	1.40	.....
53,940	580	1.58	.....
55,800	600	1.93	.....
57,660	620	.....	.....
59,520	640	.....	.....
61,380	660	.....	.....
63,240	680	.....	.....
65,100	700	.....	.....
66,960	720	.....	.....
68,820	740	.....	.....
70,680	760	.....	.....
72,540	780	.....	.....
74,400	800	.....	.....
76,260	820	.....	.....
78,120	840	.....	.....
80,000	860	.....	.....
81,880	880	.....	.....
83,760	900	.....	.....
85,640	920	.....	.....
87,520	940	.....	.....
89,400	960	.....	.....
91,280	980	.....	.....
93,160	1,000	.....	.....
				Maximum load applied. Test discontinued.

Opened along the grain at the middle of the stick, at some seasoning cracks which existed in the wood before testing.

Sample cut from post marked 4.

Compressed sidewise the grain, parallel to the rings of growth, or tangentially to the tree.



Sectional area, $9''.70 \times 8''.09 = 78.47$ square inches.

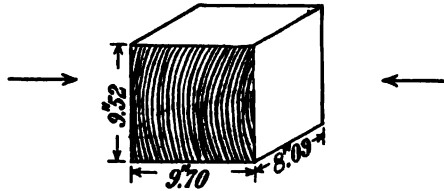
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,569	20	0.	0.	
3,139	40	.0013	.....
4,708	60	.0029	.....
6,278	80	.0042	.....
7,847	100	.0058	.....
1,569	20	.....	.0003
9,416	120	.0072	.....
10,986	140	.0088	.....
12,556	160	.0104	.....
14,125	180	.0119	.....
15,694	200	.0143	.....
1,569	20	.....	.0009
17,263	220	.0157	.....
18,833	240	.0174	.....
20,402	260	.0195	.....
21,972	280	.0225	.....
23,542	300	.0245	.....
1,569	20	.....	.0022

E = 75,000 pounds per square inch.

Above sample turned one-quarter and loaded sidewise the grain, perpendicular to the rings of growth, or radially to the tree.

No. 1426.

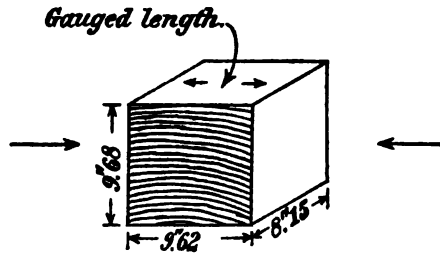


Sectional area, $9''.52 \times 8''.09 = 77.02$ square inches.
Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pou nds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	
1,540	20	0.	0.	Initial load.
3,081	40	.0015	.....
4,621	60	.0024	.....
6,162	80	.0034	.....
7,702	100	.0041	.....
1,540	20	.....	.0007	
9,242	120	.0049	.....
10,783	140	.0058	.....
12,323	160	.0065	.....
13,863	180	.0074	.....
15,404	200	.0081	.....
1,540	20	.....	.0014	
16,944	220	.0087	.....
18,484	240	.0096	.....
20,025	260	.0105	.....
21,565	280	.0115	.....
23,106	300	.0125	.....	} E = 162,000 pounds per square inch.
1,540	20	.....	.0021	
24,646	320	.0132	.....
26,187	340	.0144	.....
27,727	360	.0154	.....
29,268	380	.0166	.....
30,808	400	.0190	.....
1,540	20	.....	.0039	
30,808	400	.0194	.....
32,348	420	.0211	.....
33,889	440	.0244	.....	After 3 minutes.
35,429	460	.0289	.....	Do.
36,970	480	.0307	.....
38,510	500	.0365	.....
38,510	500	.0472	.....
1,540	20	.0585	.....	After 1½ minutes.
46,212	600	.39	.....
53,914	700	1.21	.....
61,616	800	1.73	.....
69,318	900	2.07	.....
77,020	1,000	2.25	.....
92,424	1,200	3.40	.....
154,040	2,000	2.74	.....
0	0	2.32	.....	Test discontinued.

The sample was badly distorted in shape, but remained intact without fractures along the grain.

Sample cut from stick marked 4.
Loaded tangentially, or parallel to the rings of growth.



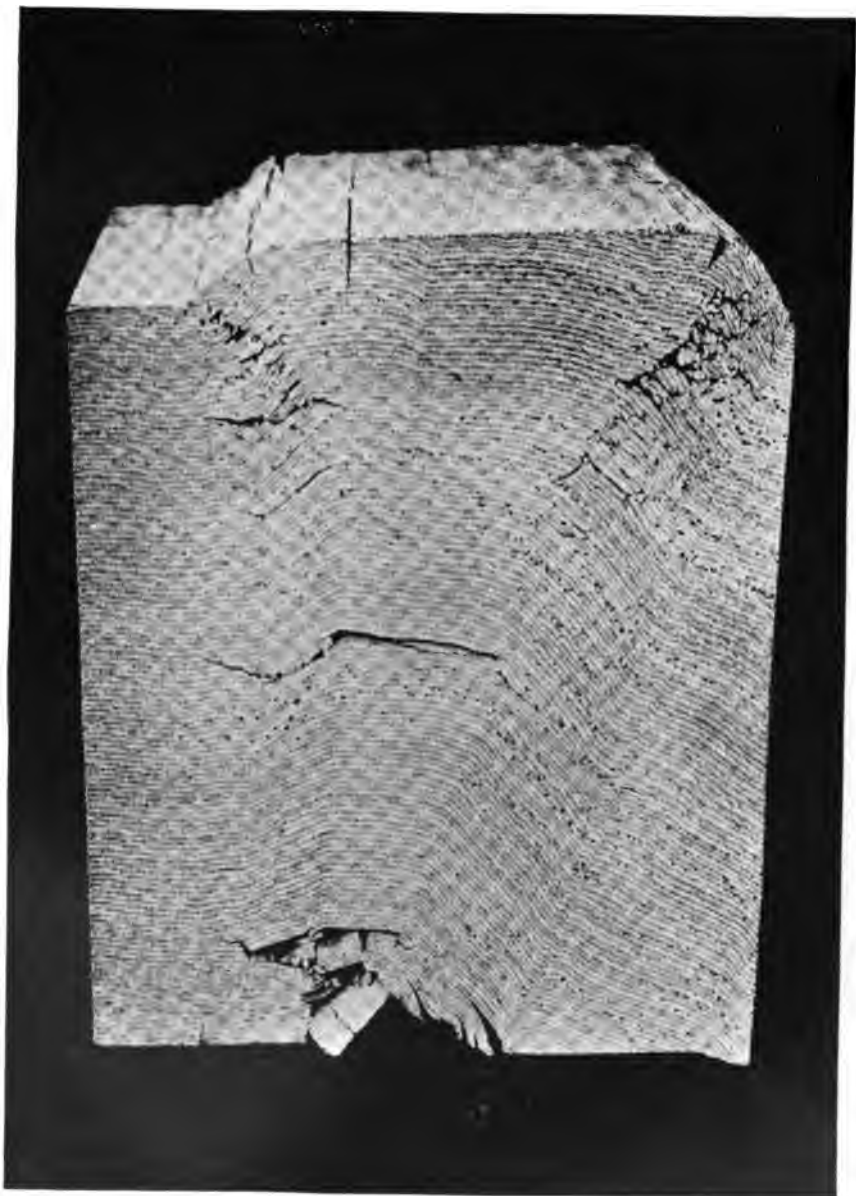
Sectional area, $9''.68 \times 8''.15 = 78.89$ square inches.
Gauged length 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 578	20	0.	0.	
3, 156	40	.0023	.....
4, 733	60	.0044	.....
6, 311	80	.0084	.....
7, 889	100	.0081	.....
1, 578	20	.....	.0011
9, 467	120	.0100	.....
11, 045	140	.0118	.....
12, 622	160	.0136	.....
14, 200	180	.0159	.....
15, 778	200	.0178	.....
1, 578	20	.....	.0021
17, 356	220	.0196	.....
18, 934	240	.0221	.....
20, 511	260	.0252	.....
22, 089	280	.0271	.....
23, 667	300	.0305	.....
1, 578	20	.....	.0052
25, 245	320	.0327	.....
26, 823	340	.0355	.....
28, 400	360	.0399	.....
29, 978	380	.0447	.....
31, 556	400	.0499	.....
1, 578	20	.....	.0125
33, 134	420	.0554	.....
34, 712	440	.0620	.....
36, 289	460	.0696	.....
37, 867	480	.0803	.....
39, 445	500	.0939	.....
500	500	.1074	.0400+	
47, 384	600	.....	.....

} E = 61,000 pounds per square inch.

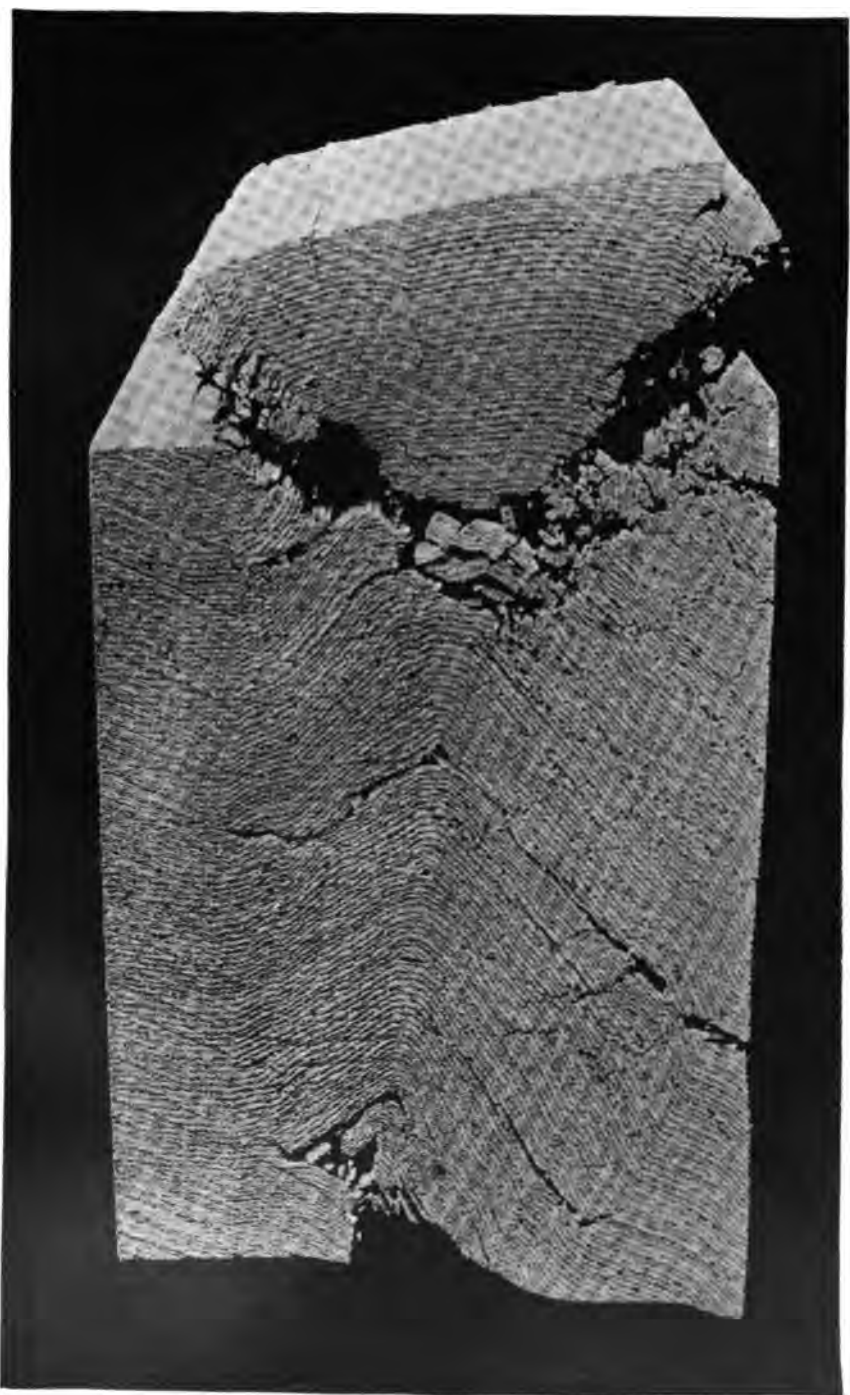
After 3 minutes rest.
Ultimate strength.

Failed by splitting along the grain between a wedge-shaped center and the sides of the specimen.



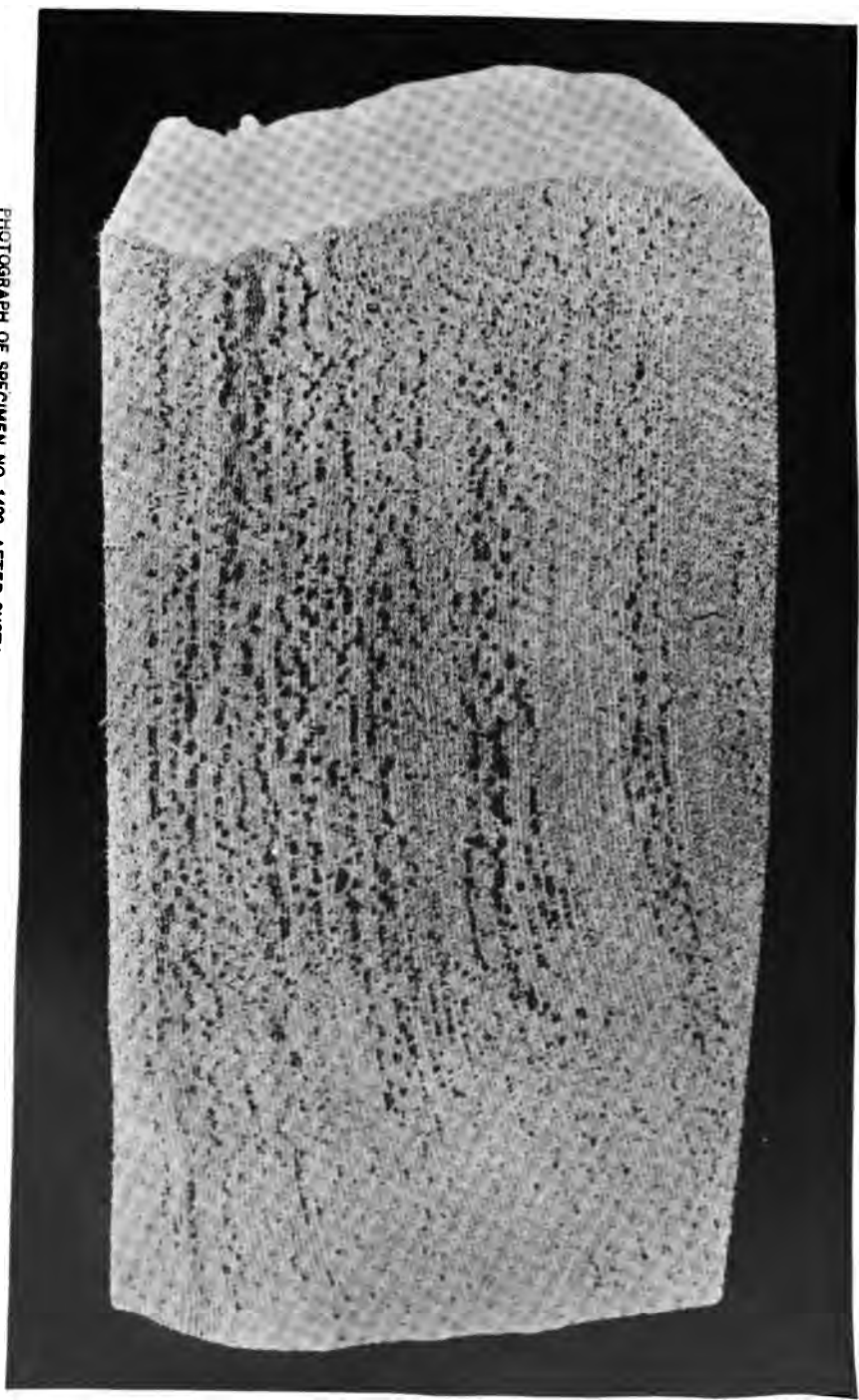
PHOTOGRAPH OF SPECIMEN NO. 1429, SHOWING EARLY STAGES OF FAILURE.



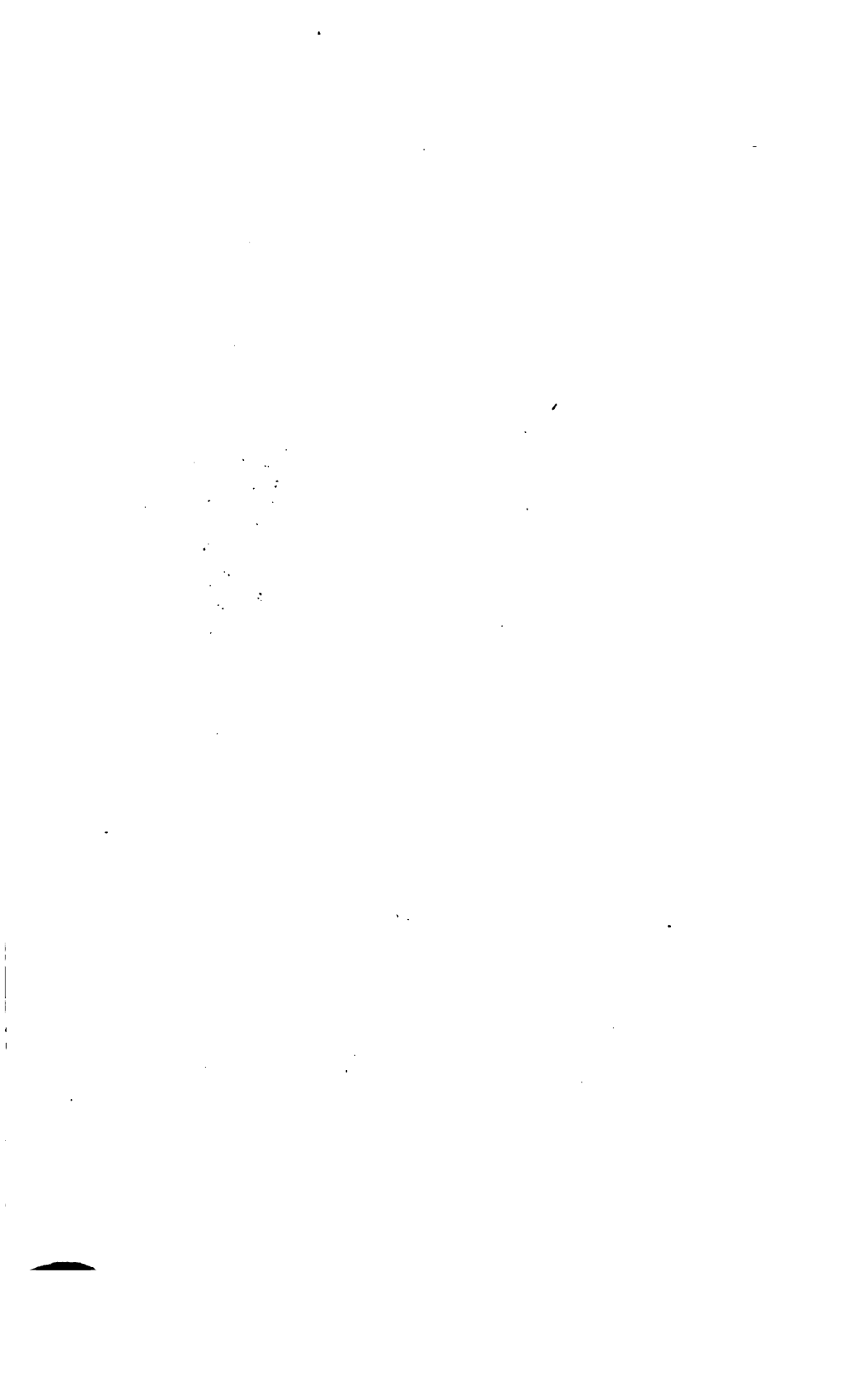


PHOTOGRAPH OF SPECIMEN NO. 1429, AFTER SUSTAINING THE MAXIMUM LOAD, 600 POUNDS PER SQUARE INCH.



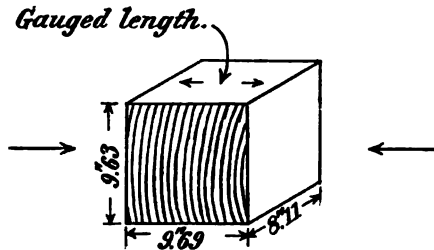


PHOTOGRAPH OF SPECIMEN NO. 1490, AFTER SUSTAINING THE MAXIMUM LOAD, 3,000 POUNDS PER SQUARE INCH.



No. 1430.

Sample from stick marked 4. Taken from end of No. 1429.
Loaded radially, or perpendicular to the rings of growth.



Sectional area, $9''.63 \times 8''.11 = 78.1$ square inches.
Gauged length, 6''.

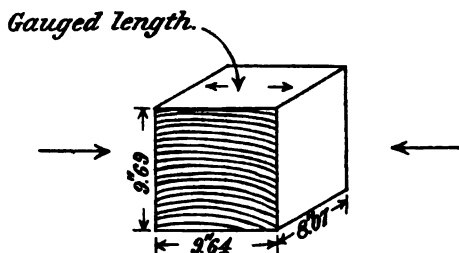
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
1,562	20	0.	0.	
3,124	40	.0004	.....
4,686	60	.0011	.....
6,248	80	.0018	.....
7,810	100	.0023	.....
1,562	20	.....	0.
9,372	120	.0030	.....
10,934	140	.0037	.....
12,496	160	.0047	.....
14,058	180	.0054	.....
15,620	200	.0064	.....
1,562	20	.....	.0001
17,182	220	.0073	.....
18,744	240	.0083	.....
20,306	260	.0093	.....
21,868	280	.0103	.....
23,430	300	.0113	.....
1,562	20	.....	.0004
24,992	320	.0123	.....
26,554	340	.0133	.....
28,116	360	.0149	.....
29,678	380	.0162	.....
31,240	400	.0175	.....
1,562	20	.....	.0010
32,802	420	.0187	.....
34,364	440	.0206	.....
35,926	460	.0218	.....
37,488	480	.0226	.....
39,050	500	.0240	.....
1,562	20	.....	.0219
40,612	520	.0260	.....
42,174	540	.28	.....
43,736	560	.42	.....
45,298	580	.60	.....
46,860	600	1.24	.....
54,870	700	1.80	.....
62,480	800	2.03	.....
70,290	900	2.24	.....
78,100	1,000	2.75	.....
156,200	2,000	2.94	.....
234,300	3,000	.....	.....

Maximum load applied.

Fibers crushed laterally, but the wood did not split along the grain.

No. 1431.

Sample from stick marked 4. Taken from end of sample No. 1430.
Loaded tangentially, or parallel to the direction of the rings of growth.



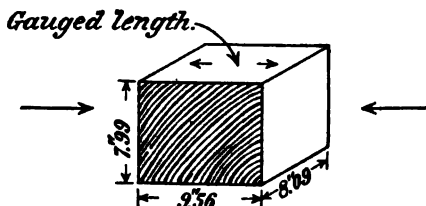
Sectional area, $9''.69 \times 8''.07 = 78.2$ square inches.
Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,564	20	0.	0.	
3,128	40	.0014	.....
4,692	60	.0080	.....
6,256	80	.0048	.....
7,820	100	.0065	.....
1,564	20	.....	.0008
9,384	120	.0081	.....
10,948	140	.0105	.....
12,512	160	.0119	.....
14,076	180	.0140	.....
15,640	200	.0159	.....
1,564	20	.....	.0019
17,204	220	.0176	.....
18,768	240	.0204	.....
20,332	260	.0224	.....
21,896	280	.0254	.....
23,460	300	.0282	.....
1,564	20	.....	.0052
25,024	320	.0294	.....
26,588	340	.0351	.....
28,152	360	.0375	.....
29,716	380	.0400	.....
31,280	400	.0426	.....
1,564	20	.....	.0129
32,844	420	.0431	.....
.....	420	.0451	.....
34,408	440	.0480	.....
35,972	460	.0507	.....
37,536	480	.06	.....
39,100	500	.07	.....
40,664	520	.07+	.....
42,228	540	.08	.....
43,792	560	.08+	.....
45,356	580	.10	.....
46,920	600	.12	.....
54,740	700	.....	.....
				Ultimate strength.

Fibers split along the grain. Continuing the loads the stick was reduced to a thickness of about 6'', the load falling in the meantime to 26,000 pounds total.

No. 1427.

Sample cut from post marked 6.
Compressed sidewise the grain. Loaded obliquely to the direction of the rings of growth.



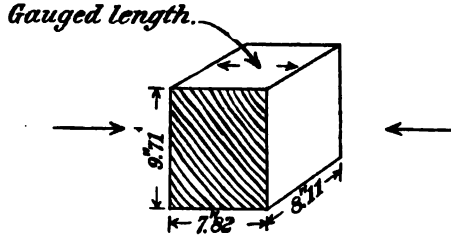
Sectional area, $8'' .09 \times 7'' .99 = 64.64$ square inches.
Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 293	20	0.	0.	
2, 586	40	.0028	.....
3, 878	60	.0062	.....
5, 171	80	.0095	.....
6, 464	100	.0130	.....
1, 293	20	.....	.0023
7, 757	120	.0165	.....
9, 050	140	.0208	.....
10, 342	160	.0241	.....
11, 635	180	.0289	.....
12, 928	200	.0339	.....
1, 293	200050	} E = 37,000 pounds per square inch.
14, 221	220	.0379	.....
15, 514	240	.0445	.....
16, 806	260	.0531	.....
.....	260	.0549	.....
.....	.....	.....	.0103
1, 293	20	After 2 minutes.
19, 392	300	.07	.....
21, 978	340	.09	.....
24, 563	380	.11	.....
27, 149	420	.14	.....
28, 400	439	Ultimate strength.

Failed by splitting along the rings of annual growth.

Sample from post marked 6.

This sample was taken off at the end of sample No. 1427, and is tested by loads applied at right angles to the direction of loading in the previous sample.



Sectional area, $9'' .71 \times 8'' .11 = 78.75$ square inches.
 Gauged length, 6''.

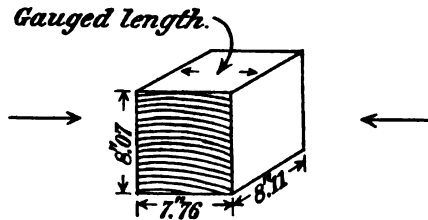
Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Compression.	Set.		
Pounds.	Pounds.	Inches.	Inch.		
1,575	20	0.	0.	Initial load.	
3,150	40	.0084			
4,725	60	.0083			
6,300	80	.0095			
7,875	100	.0120			
1,575	20		.0030		
9,450	120	.0159			
11,025	140	.0182			
12,600	160	.0220			
14,175	180	.0255			
15,750	200	.0296			
1,575	20		.0056		} E = 45,000 pounds per square inch. After 30 minutes.
17,325	220	.0327	.0054		
18,900	240	.0381			
20,475	260	.0451			
22,050	280	.0514			
23,625	300	.0596			
1,575	20		.0125		
25,200	320	.06			
26,775	340	.08			
28,350	360	.10			
29,925	380	.13			
31,500	400	.17			
33,075	420	.23			
34,650	440	.30			
36,225	460	1.09			
37,800	500	2.69			
78,750	1,000	2.12		Test discontinued.	

The sample was badly distorted but not fractured, excepting a split along the grain at one edge.

No. 1434.

Sample from stick marked 32.

Load applied tangentially, or parallel to the rings of growth.

Sectional area, $8''.07 \times 8''.11 = 65.45$ square inches.

Rate of growth, 12 rings per inch.

Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,309	20	0.	0.	
2,618	40	.0010		
3,927	60	.0022		
5,236	80	.0032		
6,545	100	.0043		
1,309	20		.0001	
7,854	120	.0054		
9,163	140	.0067		
10,472	160	.0078		
11,781	180	.0088		
13,090	200	.0100		
1,309	20		.0005	
14,399	220	.0110		
15,708	240	.0124		
17,017	260	.0135		
18,326	280	.0146		
19,635	300	.0157		
1,309	20		.0014	
20,944	320	.0167		
22,253	340	.0181		
23,562	360	.0196		
24,871	380	.0211		
26,180	400	.0226		
1,309	20		.0027	
27,489	420	.0236		
28,798	440	.0250		
30,107	460	.0270		
31,416	480	.0286		
32,725	500	.0307		
1,309	20		.0051	
34,034	520	.0326		
35,343	540	.0348		
36,652	560	.0365		
37,961	580	.0387		
39,270	600	.0404		
1,309	20		.0090	
40,579	620	.0416		
41,888	640	.0433		
43,197	660	.0444		
44,506	680			
45,815	700			
47,124	720			
48,433	740			
49,742	760			
51,051	780			
52,360	800			

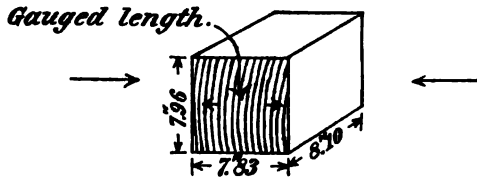
E = 112,000 pounds per square inch.

Rapid yielding occurred after passing this load.
Ultimate strength.

Failed rapidly under the maximum load, splitting along the grain.

No. 1435.

Sample from stick marked 32. Cut from stick at end of No. 1434. Loads applied radially, or perpendicular to the rings of growth.



Sectional area, $7''.96 \times 8''.10 = 64.48$ square inches.
 Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
1, 289	20	0.	0.	
2, 579	40	— .0004	.....
3, 869	60	— .0003	.....
5, 158	80	.0000	.....
6, 448	100	.0004	.....
1, 289	20	.....	— .0004
7, 738	120	.0006	.....
9, 027	140	.0011	.....
10, 317	160	.0019	.....
11, 606	180	.0026	.....
12, 896	200	.0034	.....
1, 289	20	.....	— .0005
14, 187	220	.0041	.....
15, 475	240	.0051	.....
16, 765	260	.0059	.....
18, 054	280	.0067	.....
19, 344	300	.0075	.....
1, 289	20	.....	— .0005
20, 634	320	.0084	.....
21, 923	340	.0084	.....
23, 213	360	.0102	.....
24, 502	380	.0111	.....
25, 792	400	.0120	.....
1, 289	20	.....	— .0006
27, 082	420	.0130	.....
28, 371	440	.0140	.....
29, 661	460	.0150	.....
30, 950	480	.0163	.....
32, 240	500	.0188	.....
1, 289	20	.....	.0001
33, 530	520	.0195	.....
34, 819	540	.0204	.....
36, 109	560	.0222	.....
37, 398	580	.0575	.....
38, 688	600	.20	.....
39, 978	620	1.30	.....
		1.75	.....

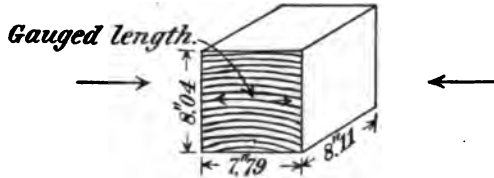
} E = 152,000 pounds per square inch.

} Maximum load applied.
Test discontinued.

The stick split along the grain at cracks near the middle of the specimen.

No. 1436.

Sample from stick marked 32. Cut off stick at end of sample No. 1435. Loaded tangentially, or parallel to the rings of growth.



Sectional area, $8''.04 \times 8''.11 = 65.2$ square inches.
Gauged length, 6".

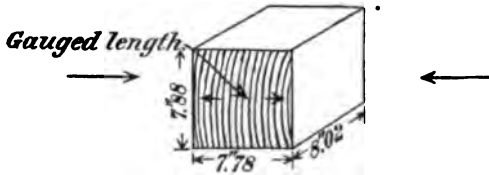
Applied loads		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
1 304	20	0.	0.	
2 608	40	.0005	.....
3 912	60	.0012	.....
5 216	80	.0021	.....
6 520	100	.0032	.....
1 304	20	.....	.0000
7 824	120	.0044	.....
9 128	140	.0056	.....
10 432	160	.0067	.....
11 736	180	.0080	.....
13 040	200	.0095	.....
1 304	20	.....	.0008
14 344	220	.0106	.....
15 648	240	.0121	.....
16 952	260	.0135	.....
18 256	280	.0150	.....
19 560	300	.0165	.....
1 304	20	.....	.0012
20 864	320	.0177	.....
22 168	340	.0196	.....
23 472	360	.0216	.....
24 776	380	.0232	.....
26 080	400	.0254	.....
1 304	20	.....	.0030
27 384	420	.0272	.....
28 688	440	.0296	.....
29 992	460	.0318	.....
31 296	480	.0346	.....
32 600	500	.0376	.....
1 304	20	.....	.0068
33 904	520	.0396	.....
35 208	540	.0431	.....
36 512	560	.0476	.....
37 816	580	.0537	.....
39 120	600	.0601	.....
40 424	620	.0669	.....
41 728	640	.0726	.....
43 032	660	.0850	.....
44 336	680	.11	.....
45 640	700	.63	.....
		1.01	.....

} E = 93,000 pounds per square inch.

Maximum load applied.
Test discontinued.

No. 1437.

Sample from stick marked 32. Cut off stick at end of No. 1436. Loads applied radially, or perpendicular to the rings of growth.



Sectional area, $7'' .88 \times 8'' .02 = 63.2$ square inches.
Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
		0.	0.	
1,264	20			} E = 155,000 pounds per square inch.
2,528	40	.0002		
3,792	60	.0004		
5,056	80	.0007		
6,320	100	.0011		
1,264	20		.0000	
7,584	120	.0016		
8,848	140	.0021		
10,112	160	.0026		
11,376	180	.0034		
12,640	200	.0041		
1,264	20		.0003	
13,904	220	.0049		
15,168	240	.0058		
16,432	260	.0065		
17,696	280	.0073		
18,960	300	.0081		
1,264	20		.0003	
20,224	320	.0089		
21,488	340	.0098		
22,752	360	.0106		
24,016	380	.0115		
25,280	400	.0125		
1,264	20		.0006	
26,544	420	.0133		
27,808	440	.0145		
29,072	460	.0167		
30,336	480	.0180		
31,600	500	.0206		
1,264	20		.0020	
32,864	520	.0222		
34,128	540	.0229		
35,392	560	.0246		
36,656	580	.08		
37,920	600	.19		
39,184	620	.50		
40,448	640	.90		
41,712	660	1.14		
42,976	680	1.45		
44,240	700	1.69		
0	1,000	2.51		
126,400	2,000	3.03		
189,600	3,000	3.33		
252,800	4,000	3.58		
316,000	5,000	3.78		
0	0	3.25		
0	0	3.04		
0	0	2.91		

Maximum load applied.
Immediate set.
Set after 10 minutes.
Test discontinued.
Set after 2 days' rest.

Lateral expansion in the direction perpendicular to the rings of growth. Observations made on the second gauged length of 6''.

Loads applied as before, tangentially, or parallel to the rings of growth.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1, 291	20	0.	0.	
6, 456	100	.0016	.....
12, 912	200	.0039	.....
19, 368	300	.0064	.....
12, 912	200	.0043	.....
6, 456	100	.0020	.....
1, 291	20	.....	.0001
6, 456	100	.0018	.....
12, 912	200	.0041	.....
19, 368	300	.0065	.....
12, 912	200	.0044	.....
6, 456	100	.0020	.....
1, 291	20	.....	.0001

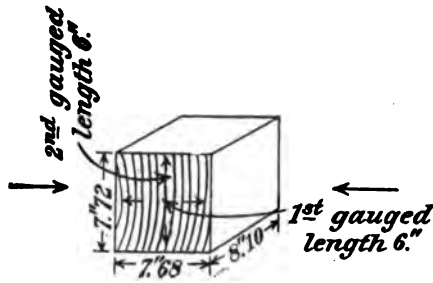
Observations on the first gauged length repeated.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
1, 291	20	0.	0.	
6, 456	100	.0043	.....
12, 912	200	.0113	.....
19, 368	300	.0192	.....
12, 912	200	.0124	.....
6, 456	100	.0055	.....
1, 291	20	.....	.0007

No. 1453.

Sample cut from stick marked 32.

Loaded radially, or perpendicular to the rings of growth.

Sectional area, $7''.72 \times 8''.10 = 62.5$ square inches.

Observations on the first gauged length, in the direction of the applied loads.

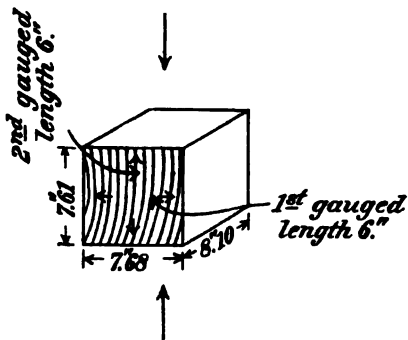
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,250	20	0.	0.	Initial load.
2,500	40	.0010	.....
3,750	80	.0018	.....
5,000	80	.0027	.....
6,250	100	.0038	.....
1,250	20	.....	.0000
7,500	120	.0045	.....
8,750	140	.0054	.....
10,000	180	.0064	.....
11,250	180	.0073	.....
12,500	200	.0082	.....
1,250	20	.....	.0000
13,750	320	.0090	.....
15,000	240	.0100	.....
16,250	260	.0108	.....
17,500	280	.0118	.....
18,750	300	.0127	.....
1,250	200001	} $E = 134,800$ pounds per square inch.
6,250	100	.0037	.....
12,500	200	.0082	.....
18,750	800	.0128	.....
1,250	20	.....	.0001
1,250	20	.....	.0001

Lateral expansion determinations on the second gauged length.

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Lateral expansion.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>		
1,250	20	0.	0.	Initial load.	
6,250	100	.0025	.....	
12,500	200	.0053	.....	
18,750	800	.0079	.....	
1,250	200001		} Ratio of lateral expansion to longitudinal compression, 1:51.
6,250	100	.0027	.....	
12,500	200	.0054	.....	
18,750	300	.0080	.....	
12,500	200	.0056	.....	
6,250	100	.0029	.....	
1,250	20	.....	.0002

No. 1453 a.

Specimen No. 1453 dressed on two other sides and again adjusted in the machine. Now loaded tangentially, or parallel to the rings of growth.



Sectional area, $7''.68 \times 8.10 = 62.2$ square inches.
 Observations on the second gauged length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
1,244	20	0.	0.	Initial load.
2,488	40	.0019	.....
3,732	60	.0035	.....
4,976	80	.0050	.....
6,220	100	.0064	.....
1,244	20	.....	0.
7,464	120	.0078	.....
8,708	140	.0093	.....
9,952	160	.0108	.....
11,196	180	.0121	.....
12,440	200	.0136	.....
1,244	20	.....	.0006
13,684	220	.0150	.....
14,928	240	.0168	.....
16,172	260	.0183	.....
17,416	280	.0201	.....
18,660	300	.0218	.....
1,244	200017	} E = 83,580 pounds per square inch.
0,220	100	.0077	.....
12,440	200	.0147	.....
18,660	300	.0221	.....
12,440	200	.0155	.....
6,220	100	.0085	.....
1,244	20	.....	.0019

Lateral expansion determinations on the first gauged length.

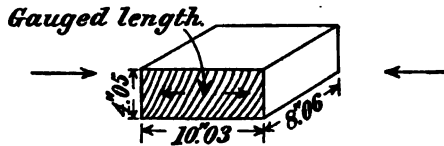
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. Ratio of lateral expansion to longitudinal compression, $\frac{1}{175}$.
1, 244	20	0.	0.	
6, 220	100	.0023	.....
12, 440	200	.0048	.....
18, 660	300	.0073	.....
1, 244	20	.....	.0001
6, 220	100	.0024	
12, 440	200	.0050	
18, 660	300	.0074	
12, 440	200	.0050	
6, 220	100	.0025	
1, 244	200001	

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No. 1438.

Sample cut from stick No. 33.

Loaded radially, or perpendicular to the rings of growth.

Sectional area, $4''.05 \times 8''.06 = 32.64$ square inches.

Rate of growth, 11 rings per inch.

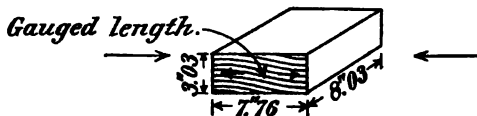
Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
853	20	0.	0.	
1, 306	40	.0006	.....
1, 958	60	.0014	.....
2, 611	80	.0025	.....
3, 264	100	.0036	.....
853	20	.....	.0001
3, 917	120	.0045	.....
4, 570	140	.0059	.....
5, 222	160	.0070	.....
5, 875	180	.0082	.....
6, 528	200	.0095	.....
853	20	.....	.0002
7, 181	220	.0105	.....
7, 834	240	.0118	.....
8, 486	260	.0135	.....
9, 139	280	.0146	.....
9, 792	300	.0162	.....
853	20	.....	.0008
10, 445	320	.0171	.....
11, 098	340	.0188	.....
11, 750	360	.0205	.....
12, 403	380	.0222	.....
13, 056	400	.0240	.....
853	20	.....	.0016
13, 709	420	.0251	.....
14, 362	440	.0271	.....
15, 014	460	.0294	.....
15, 667	480	.0327	.....
16, 320	500	.0351	.....
853	20	.....	.0037
16, 973	520	.0401	.....
17, 626	540	.0447	.....
18, 278	560	.08	.....
18, 931	580	.20	.....
19, 584	600	.29	.....
22, 848	700	1.11	.....
				Maximum load applied. Test discontinued.

E = 102,000 pounds per square inch.

No. 1439.

Sample cut from a stick 7" × 8" by 18 feet long.
 Loads applied tangentially, or parallel to the rings of growth.



Sectional area, $3''.03 \times 8''.03 = 24.33$ square inches.
 Rate of growth, 25 rings per inch.
 Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
		0.	0.	
486	20			
972	40	.0009	.....
1,460	60	.0018	.....
1,946	80	.0031	.....
2,433	100	.0049	.....
486	20		0.	
2,920	120	.0068	.....
3,406	140	.0088	.....
3,893	160	.0104	.....
4,379	180	.0126	.....
4,866	200	.0143	.....
486	20		.0006	
5,353	220	.0161	.....
5,839	240	.0185	.....
6,326	260	.0208	.....
6,812	280	.0233	.....
7,299	300	.0260	.....
486	20		.0021	
7,786	320	.0289	.....
8,272	340	.0320	.....
8,759	360	.0354	.....
9,245	380	.0388	.....
9,732	400	.0425	.....
486	20		.0054	} E = 61,000 pounds per square inch. Load left on specimen 40 hours.
4,866	200	.0198	.....
486	20		.0054	Micrometer reset to last reading.
9,732	400	.0390	.....
	400	.0434	.....	After 3 minutes.
	400	.0451	.....	After 5 minutes.
10,219	420	.0480	.....
10,705	440	.0511	.....
11,192	460	.0570	.....
12,165	500	.07	.....
14,598	600	.26	.....	Maximum load applied. Test discontinued. Fibers crushed.

TENSION TESTS.

No. 8513.

Stick No. 26.

Dimensions, 8".12 × 3".02 by 24' 2 $\frac{1}{2}$ " long.

Weight, 163 pounds=39.6 pounds per cubic foot.

Average rate of growth, 15 rings per inch.

Ends held by friction grip holders.

Counterweighted at middle.

Distance between jaws of machine, 245".

Sectional area, 24.5 square inches.

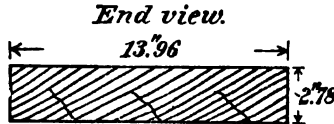
Gauged length, 200".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
2,450	100	0.	0.	
4,900	200	.0078		
7,350	300	.0153		
9,800	400	.0234		
12,250	500	.0309		
2,450	100		.0005	
14,700	600	.0386		
17,150	700	.0464		
19,600	800	.0530		
22,050	900	.0610		
24,500	1,000	.0690		
2,450	100		.0009	
26,950	1,100	.0761		
29,400	1,200	.0833		
31,850	1,300	.0911		
34,300	1,400	.0985		
36,750	1,500	.1066		
24,500	1,000	.0699		
12,250	500	.0319		
2,450	100		.0009	
12,250	500	.0312		
24,500	1,000	.0689		
36,750	1,500	.1062		
39,200	1,600	.1141		
41,650	1,700	.1220		
44,100	1,800	.1294		
46,550	1,900	.1370		
49,000	2,000	.1440		
2,450	100		.0009	} E = 2,655,000 pounds per square inch.
51,450	2,100	.1493		
53,900	2,200	.1570		
56,350	2,300	.1645		
58,800	2,400	.1716		
61,250	2,500	.1796		
49,000	2,000	.1429		
36,750	1,500	.1063		
24,500	1,000	.0693		
12,250	500	.0310		
2,450	100		-.0007	} E = 2,662,000 pounds per square inch.
12,250	500	.0298		
24,500	1,000	.0673		
36,750	1,500	.1049		
49,000	2,000	.1420		
61,250	2,500	.1791		
49,000	2,000	.1424		
36,750	1,500	.1060		
24,500	1,000	.0689		
12,250	500	.0292		
2,450	100		-.0010	

Stick No. 30.—6" × 14" by 24 feet long, split edgewise into two pieces, and each piece tested by tension.

No. 8514.

First piece from stick No. 30.
 Dimensions, 13".96 × 2".78 by 24 feet, 3½ inches long.
 Average rate of growth, 14 rings per inch.
 Counterweighted at the middle.
 Sectional area, 38.8 square inches.
 Gauged length, 200".



Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
3,880	100	0.	0.	Initial load.
7,760	200	.0106	.....
11,640	300	.0213	.....
15,520	400	.0319	.....
19,400	500	.0427	.....
3,880	100	.....	.0008
23,280	600	.0532	.....
27,160	700	.0637	.....
31,040	800	.0746	.....
34,920	900	.0853	.....
38,800	1,000	.0957	.....
3,880	1000019	After 1 hour.
42,680	1,100	.1057	.....
46,560	1,200	.1162	.....
50,440	1,300	.1275	.....
54,320	1,400	.1380	.....
58,200	1,500	.1487	.....
38,800	1,000	.0978	.....
19,400	500	.0461	.....
3,880	100	.....	.0026
.....	100	.....	.0015
19,400	500	.0439	E=1,923,000 pounds per square inch.
38,800	1,000	.0858	.....
58,200	1,500	.1483	.....
38,800	1,000	.0975	.....
19,400	500	.0454	E=1,929,000 pounds per square inch.
3,880	100	.....	.0027
19,400	500	.0442	.....
38,800	1,000	.0962	.....
58,200	1,500	.1482	E=1,929,000 pounds per square inch.
38,800	1,000	.0979	.....
19,400	500	.0459	.....
3,880	1000030	

No. 8544.

Second piece from stick No. 30.
 Dimensions, $13''\text{.96} \times 3''\text{.05}$ by $24' - 3\frac{1}{4}''$ long.
 Weight, $239\frac{3}{4}$ pounds = 33.4 pounds per cubic foot.
 Average rate of growth, 14 rings per inch.
 Counterweighted at the middle.
 Sectional area, 42.58 square inches.
 Gauged length, 200''.

End view.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
4,258	100	0.	0.	Initial load.
8,516	200	.0111		
12,774	300	.0223		
17,032	400	.0335		
21,290	500	.0450		
25,548	600	.0560		
29,806	700	.0675		
34,064	800	.0788		
38,322	900	.0904		
42,580	1,000	.1015		
46,838	1,100	.1124		
4,258	100		.0010	} E = 1,787,000 pounds.
51,096	1,200	.1228		
55,354	1,300	.1342		
59,612	1,400	.1462		
63,870	1,500	.1579		
68,128	1,600	.1690		
4,258	100		.0011	
72,386	1,700	.1795		
76,644	1,800	.1916		
80,902	1,900	.2035		
85,160	2,000	.2152		
89,418	2,100	.2265		
4,258	100		.0007	} E = 1,763,000 pounds per square inch.
93,676	2,200	.2387		
97,934	2,300	.2490		
102,192	2,400	.2614		
85,160	2,000	.2170		
63,870	1,500	.1699		
42,580	1,000	.1040		
21,290	500	.0473		
4,258	100		.0005	
	100		-.0012	
21,290	500	.0430		After 5 minutes.
42,580	1,000	.0894		
63,870	1,500	.1570		
85,160	2,000	.2139		
63,870	1,500	.1580		
42,580	1,000	.1024		
21,290	500	.0459		
4,258	100		-.0004	
	100		-.0022	
	100		-.0032	
8,516	200	.0084		After 10 minutes. After 15 hours.
12,774	300	.0196		
17,032	400	.0312		
21,290	500	.0429		
17,032	400	.0324		
12,774	300	.0215		
8,516	200	.0100		
4,258	100		-.0021	
21,290	500	.0421		

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
42,580	1,000	.0989	
63,850	1,500	.1560	.....
85,160	2,000	.2138	.....
102,192	2,400	.2622	.....
85,160	2,000	.2174	.....
63,870	1,500	.1616	.....
42,580	1,000	.1052	.....
21,290	500	.0485	.....
4,258	100		+ .0005	
	100		- .0008	

Lateral contraction under endwise tensile stresses.
 Transverse gauged length at middle of length of stick, 12".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral contraction.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
4,258	100	0.	0.	Initial load.
42,580	1,000	.0020	.....
85,160	2,000	.0050	.....
102,192	2,400	.0063	.....
85,160	2,000	.0052	.....
42,580	1,000	.0023	.....
4,258	100		0.	
42,580	1,000	.0022	.....
85,160	2,000	.0050	.....
102,192	2,400	.0063	.....
85,160	2,000	.0051	.....
42,580	1,000	.0022	.....
4,258	100		0.	

Transverse gauged length 12", taken near extremity A of the 200" longitudinal gauged length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral contraction.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Set.</i>	
4,258	100	0.	0.	Initial load.
42,580	1,000	.0016	.....
85,160	2,000	.0038	.....
102,192	2,400	.0044	.....
85,160	2,000	.0036	.....
42,580	1,000	.0016	.....
4,258	100		0.	

Transverse gauged length 12'', taken near extremity B of the 200'' longitudinal gauged length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral contraction.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
4, 258	100	0.	0.	
42, 580	1, 000	.0039	.....
85, 160	2, 000	.0081	.....
102, 192	2, 400	.0101	.....
85, 160	2, 000	.0084	.....
42, 580	1, 000	.0041	.....
4, 258	100	.....	0.

Observations on longitudinal extension resumed.
Gauged length 50'', taken at end A of the stick.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
4, 258	100	0.	0.	
42, 580	1, 000	.0252	.....
85, 160	2, 000	.0535	.....
102, 192	2, 400	.0649	.....
85, 160	2, 000	.0541	.....
42, 580	1, 000	.0263	.....
4, 258	100	.....	.0005

Gauged length 50'', taken at end B of the stick.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
4, 258	100	0.	0.	
42, 580	1, 000	.0257	.....
85, 160	2, 000	.0543	.....
102, 192	2, 400	.0660	.....
85, 160	2, 000	.0551	.....
42, 580	1, 000	.0263	.....
4, 258	100	.....	.0003

No. 8543.

Stick No. 41.

Dimensions, 11".96 x 4".1 by 24' - 2 3/4" long.

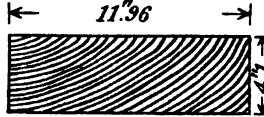
Weight, 323 1/2 pounds = 39.8 pounds per cubic foot.

Counterweighted at the middle.

Sectional area, 49.04 square inches.

Gauged length, 200".

End view.



Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>		
4, 904	100	0.	0.	Initial load.	
9, 808	200	.0117			
14, 712	300	.0234			
19, 616	400	.0351			
24, 520	500	.0469			
29, 424	600	.0586			
34, 328	700	.0710			
39, 232	800	.0829			
44, 136	900	.0948			
49, 040	1, 000	.1070			
53, 944	1, 100	.1189			
49, 040	1, 000	.1088			
44, 136	900	.0975			
39, 232	800	.0860			
34, 328	700	.0743			
29, 424	600	.0629			
24, 520	500	.0514			
19, 616	400	.0396			
14, 712	300	.0278			
9, 808	200	.0160			
4, 904	100		.0039	} E = 1,739,000 pounds per square inch.	
			.0032		
9, 808	200	.0144			After 3 minutes.
14, 712	300	.0260			
19, 616	400	.0376			
24, 520	500	.0493			
29, 424	600	.0611			
34, 328	700	.0730			
39, 232	800	.0847			
44, 136	900	.0969			
49, 040	1, 000	.1085			
53, 944	1, 100	.1201			
58, 848	1, 200	.1320			After 2 minutes.
63, 752	1, 300	.1445			
68, 656	1, 400	.1561			
73, 560	1, 500	.1680			
78, 464	1, 600	.1806			
	1, 600	.1811			
83, 368	1, 700	.1933			
88, 272	1, 800	.2050			
				Stick slipped in the holder jaws of the machine, disturbing the micrometer. The micrometer was readjusted and the stress then released to initial load, and micrometer reading taken.	
4, 904	100		.0139		
93, 176	1, 900	.2136			
4, 904	100		.0114		
93, 176	1, 900	.2132			
4, 904	100		.0121	} E = 1,780,000 pounds per square inch.	
	100		.0082		
9, 808	200	.0194		After 1 hour.	

No. 8543—Continued.

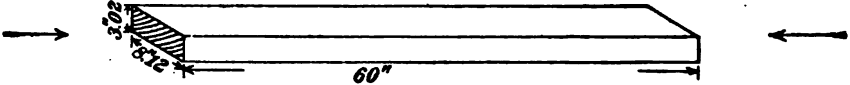
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
14, 712	300	.0310	Test discontinued.
19, 616	400	.0425	.....
24, 520	500	.0541	.....
29, 424	600	.0660	.....
34, 328	700	.0775	.....
39, 232	800	.0889	.....
44, 136	900	.1005	.....
49, 040	1, 000	.1120	.....
53, 944	1, 100	.1231	.....
49, 040	1, 000	.1129	.....
44, 136	900	.1019	.....
39, 232	800	.0904	.....
34, 328	700	.0791	.....
29, 424	600	.0678	.....
24, 520	500	.0564	.....
19, 616	400	.0449	.....
14, 712	300	.0333	.....
9, 808	200	.0218	.....
4, 904	100	.....	.0098

COMPRESSION TESTS.

No. 1449.

Stick No. 26.

Sample cut from tension specimen No. 8513.



Sectional area, $3''.02 \times 8''.12 = 24.5$ square inches.
Gauged length, $50''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
2,450	100	0.	0.	Initial load. E = 3,461,000 pounds per square inch.
4,900	200	.0012	.....
7,350	300	.0025	.....
9,800	400	.0040	.....
12,250	500	.0052	.....
2,450	100	.....	.0001
14,700	600	.0068	.....
17,150	700	.0081	.....
19,600	800	.0100	.....
22,050	900	.0114	.....
24,500	1,000	.0131	.....
2,450	100	.....	.0001
29,400	1,200	.0162	.....
34,300	1,400	.0195	.....
39,200	1,600	.0229	.....
44,100	1,800	.0260	.....
49,000	2,000	.0294	.....
2,450	100	.....	.0002
53,900	2,200	.0323	.....
58,800	2,400	.0356	.....
63,700	2,600	.0390	.....
68,600	2,800	.0423	.....
73,500	3,000	.0455	.....
2,450	100	.....	.0001

Lateral expansion under endwise compression loads.
Transverse gauged length, $7''$.

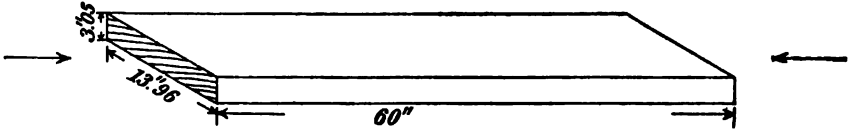
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
2,450	100	0.	0.	Initial load.
24,500	1,000	.0010	.....
49,000	2,000	.0022	.....
73,500	3,000	.0034	.....
49,000	2,000	.0022	.....
24,500	1,000	.0010	.....
2,450	100	.....	0.
193,100	7,882	.....	.....

Ultimate strength.
Failed by triple flexure.

No. 1451.

Stick No. 30.

Sample cut from tension specimen No. 8544.



Sectional area, $3''.05 \times 13''.96 = 42.58$ square inches.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
4,258	100	0.	0.	Initial load. } $E = 1,915,000$ pounds per square inch.
8,516	200	.0020	.....
12,774	300	.0045	.....
17,032	400	.0069	.....
21,290	500	.0095	.....
4,258	100	.....	— .0004
25,548	600	.0121	.....
29,806	700	.0146	.....
34,064	800	.0174	.....
38,322	900	.0201	.....
42,580	1,000	.0230	.....
4,258	100	.....	— .0005
51,096	1,200	.0282	.....
59,612	1,400	.0337	.....
68,128	1,600	.0395	.....
76,644	1,800	.0450	.....
85,160	2,000	.0506	.....
4,258	100	.....	— .0002
93,676	2,200	.0557	.....
102,192	2,400	.0614	.....
110,708	2,600	.0670	.....
119,224	2,800	.0727	.....
127,740	3,000	.0782	.....
.....	100	.....	.0000

Lateral expansion under endwise compression loads.

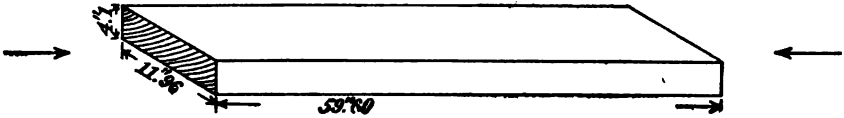
Transverse gauged length, 12".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
4,258	100	0.	0.	Initial load.
42,580	1,000	.0033	.....
85,160	2,000	.0071	.....
127,740	3,000	.0111	.....
85,160	2,000	.0074	.....
42,580	1,000	.0035	.....
4,258	100	.....	.0002
127,740	3,000	.0111	.....
.....	3,000	.0116	.....
.....	3,000	.0118	.....
4,258	1000005	After 5 minutes.
237,100	5,568	After 10 minutes.
.....	Ultimate strength.
.....	Failed by triple flexure.

No. 1452.

Stick No. 41.

Sample cut from tension specimen No. 8543.

Sectional area, $4'' \times 11'' \cdot 96 = 49.04$ square inches.

Gauged length, 50''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
4,904	100	0.	0.	Initial load. } $E = 2,036,000$ pounds per square inch.
9,808	200	.0021	.....
14,712	300	.0044	.....
19,616	400	.0068	.....
24,520	500	.0092	.....
4,904	100	.....	— .0004
29,424	600	.0117	.....
34,328	700	.0141	.....
39,232	800	.0166	.....
44,136	900	.0191	.....
49,040	1,000	.0216	.....
4,904	100	.....	— .0005
58,848	1,200	.0281	.....
68,656	1,400	.0314	.....
78,464	1,600	.0364	.....
88,272	1,800	.0415	.....
98,080	2,000	.0466	.....
4,904	100	.....	— .0004
107,888	2,200	.0514	.....
117,696	2,400	.0566	.....
127,504	2,600	.0620	.....
137,312	2,800	.0674	.....
147,120	3,000	.0728	.....
4,904	100	.....	+ .0004

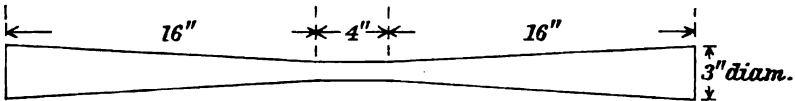
Lateral expansion under endwise compression loads.

Transverse gauged length, 10''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
4,904	100	0.	0.	Initial load.
49,040	1,000	.0017	.....
98,080	2,000	.0036	.....
147,120	3,000	.0057	.....
98,080	2,000	.0038	.....
49,040	1,000	.0020	.....
4,904	1000002	Ultimate strength.
305,060	6,220	.....	.....

Failed by triple flexure. Fibers crushed 12'' from end of stick.

TENSION TESTS.



No. of test.	No. of stick.	Diameter.	Sectional area.	Tensile strength.		Fracture.
				Total.	Per square inch.	
		<i>Inches.</i>	<i>Sq. in.</i>	<i>Pounds.</i>	<i>Pounds.</i>	
8554	28	1.02	0.817	19,720	24,137	Long splintering.
8555	28	1.02	.817	18,100	22,154	Do.
8556	28	1.02	.817	18,150	22,215	Do.
8557	(1st) 30	.98	.754	9,620	12,759	Sheared along the grain. Stick not fractured by tension.
8558	(1st) 30	1.01	.801	9,100	11,361	Short brittle.
8559	(1st) 30	1	.785	9,520	12,127	Oblique. In part sheared along the grain.
8560	(2d) 30	.99	.770	9,460	12,286	Short brittle, oblique.
8561	(2d) 30	.99	.770	9,020	11,714	Sheared along the grain.
8562	(2d) 30	.98	.754	8,310	11,021	Short brittle.
8566	(2d) 30	1	.785	9,460	12,051	Sheared along the grain.
8607	28	1	.785	16,200	20,637	Sheared along the grain, pulling out an irregular shaped core about $\frac{3}{4}$ " by $1\frac{1}{4}$ " in cross-section dimensions. Tensile strength not reached.
8608	28	1	.785	17,310	22,051	Long splintering.
8609	28	.98	.754	17,980	23,846	In part long splintering and in part sheared the wood along the grain.
8610	30	.98	.754	9,100	12,069	Oblique fracture. Sheared along the grain.
8611	30	.98	.754	6,320	8,382	Do.
8612	30	.98	.754	8,100	10,742	Do.
8613	41	1	.785	6,020	7,689	Do.
8614	41	.97	.739	6,950	9,405	Do.
8615	41	.98	.754	5,660	7,507	Do.

No. 8566 tested wet, after-48 hours immersion in water.

Specimens 8607 to 8615, inclusive, were turned out and tested two months later than the tension specimens previously tested.

WHITE OAK WOOD

FROM

C. C. MENGEL, JR., & BRO., LOUISVILLE, KY.



WHITE OAK WOOD.

These sticks were tested under compression loads applied endwise the grain, excepting a block taken from post No. 1422, which was loaded crosswise the grain in the direction radial to the tree. Micrometer observations were made on the compressibility of the wood in each test, from which results the moduli of elasticity were computed.

The relative rigidity of the wood lengthwise and crosswise the grain is shown by the results from post No. 1422, which gave the value 1,675,000 pounds per square inch for the modulus of elasticity under endwise loads, and 210,000 pounds per square inch for the value under loads crosswise the grain.

The compressibility of post No. 1418 was observed under continued stress at 3,000 pounds per square inch. There was comparatively rapid yielding during the first five minutes, which diminished in rate during the next ten minutes.

During the interval of one hour following, the rate of compression continued with considerable uniformity. The post thereafter showed an accelerating rate of yielding.

After the lapse of one hour and thirty minutes the load was diminished in decrements of 200 pounds per square inch each. After each decrement the load was sustained two minutes.

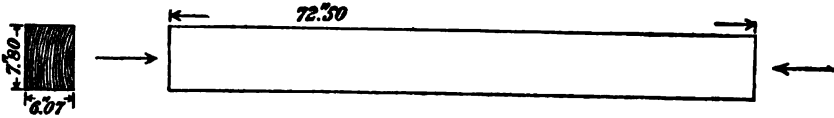
Under 2,800 pounds per square inch a further compression of ".0031 occurred; under 2,600 pounds per square inch the additional compression was ".0005; under 2,400 pounds per square inch no change in the gauged length was apparent, and under the subsequent lower stresses the effect of each pause of two minutes was a gain in length instead of additional compression.

After the loads were diminished to 1,600 pounds per square inch they were again increased, with the result that under 2,000 pounds per square inch and upward each interval of two minutes was accompanied by additional yielding, which proceeded with an accelerating rate as the loads advanced.

The ultimate resistance of this post reached 3,508 pounds per square inch, which load was momentarily sustained. Its behavior under 3,000 pounds per square inch indicated that ultimate failure might have been reached by longer continuance under stress at that limit.

COMPRESSION TESTS.

No. 1418.



Sectional area, 47.35 square inches.
 Weight, 95½ pounds = 47.9 pounds per cubic foot.
 Rate of growth, 12 rings per inch.
 Gauged length, 50''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load. After 1 hour 10 minutes. After 1 hour 15 minutes. After 1 hour 20 minutes. After 1 hour 25 minutes. After 1 hour 30 minutes.
4, 735	100	0.	0.	
9, 470	200	.0036	.....
14, 205	300	.0072	.....
18, 940	400	.0109	.....
23, 675	500	.0148	.....
28, 410	600	.0188	.....
33, 145	700	.0224	.....
37, 880	800	.0261	.....
42, 615	900	.0304	.....
47, 350	1, 000	.0341	.....
4, 735	100	.....	.0008
56, 820	1, 200	.0414	.....
66, 290	1, 400	.0491	.....
75, 760	1, 600	.0573	.....
85, 230	1, 800	.0655	.....
142, 050	3, 000	.2401	.....
.....	3, 000	.2470	.....
.....	3, 000	.2551	.....
.....	3, 000	.2657	.....
.....	3, 000	.2809	.....

Post shows evidence of crushing the fibers in the vicinity of some sound knots.

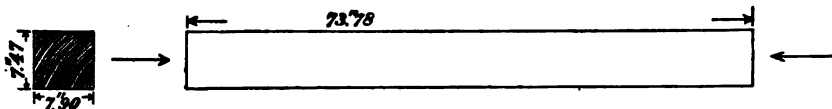
COMPRESSION TESTS—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
132,580	2,800	0.2748		After 2 minutes.
	2,800	.2779		
123,110	2,600	.2706		Do.
	2,600	.2712		
113,640	2,400	.2634		Do.
	2,400	.2634		
104,170	2,200	.2553		Do.
	2,200	.2550		
94,700	2,000	.2409		Do.
	2,000	.2461		
85,230	1,800	.2375		Do.
	1,800	.2366		
75,780	1,600	.2280		Do.
	1,600	.2267		
85,230	1,800	.2345		Do.
	1,800	.2344 +		
94,700	2,000	.2427		Do.
	2,000	.2430		
104,170	2,200	.2515		Do.
	2,200	.2520		
94,700	2,000	.0741		} E = 1,338,000 pounds per square inch.
4,735	100		.0031	
104,170	2,200	.0839		
113,640	2,400	.0933		
123,110	2,600	.1051		
132,580	2,800	.1177		
142,050	3,000	.1380		
94,700	2,000	.1010		
47,350	1,000	.0589		
4,735	100		.0184	
47,350	1,000	.0537		
94,700	2,000	.0950		
142,050	3,000	.1394		
	3,000	.1454		
	3,000	.1488		After 1 minute.
	3,000	.1530		After 2 minutes.
	3,000	.1565		After 3 minutes.
	3,000	.1653		After 5 minutes.
	3,000	.1725		After 10 minutes.
	3,000	.1788		After 15 minutes.
	3,000	.1848		After 20 minutes.
	3,000	.1910		After 25 minutes.
	3,000	.1972		After 30 minutes.
	3,000	.2034		After 35 minutes.
	3,000	.2096		After 40 minutes.
	3,000	.2156		After 45 minutes.
	3,000	.2216		After 50 minutes.
	3,000	.2278		After 55 minutes.
	3,000	.2336		After 60 minutes.
113,640	2,400	.2602		After 1 hour 5 minutes.
	2,400	.2612		
123,110	2,600	.2697		
	2,600	.2715		
132,580	2,800	.2807		
	2,800	.2853		
142,050	3,000	.2960		
166,100	3,508			Maximum load sustained.

The interval of time between the last reading of the micrometer under 3,000 pounds per square inch and the time of reaching the maximum load was one minute.

Failure occurred by the fibers crushing at some knots 1½" diameter 30" from the end of the post.

No. 1419.



Sectional area, 59.01 square inches.

Weight, 123½ pounds = 49 pounds per cubic foot.

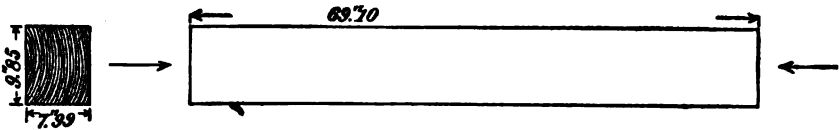
Rate of growth, 11 rings per inch.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
		0.	0.	
5,901	100			} E = 1,399,000 pounds per square inch.
11,802	200	.0050	.....
17,703	300	.0094	.....
23,604	400	.0137	.....
29,505	500	.0174	.....
35,406	600	.0212	.....
41,307	700	.0247	.....
47,208	800	.0285	.....
53,109	900	.0321	.....
59,010	1,000	.0355	.....
5,901	100		.0011	
70,812	1,200	.0424	.....
82,614	1,400	.0495	.....
94,416	1,600	.0564	.....
106,218	1,800	.0637	.....
118,020	2,000	.0710	.....
5,901	100		.0031	
129,822	2,200	.0782	.....
141,624	2,400	.0855	.....
153,426	2,600	.0938	.....
165,228	2,800	.1023	.....
177,030	3,000	.1141	.....
5,901	100		.0103	
188,832	3,200	.1243	.....
200,634	3,400	.1335	.....
212,436	3,600	.1457	.....
224,238	3,800	.1642	.....
236,040	4,000	.1911	.....
5,901	100		.0320	
247,842	4,200	.2940	.....
258,000	4,372		.....
				Ultimate strength.

Fibers crushed at a knot one-half inch diameter 20" from end of post.

No. 1420.

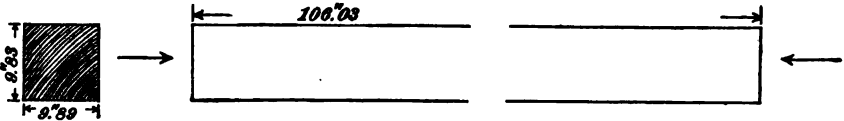


Sectional area, 78.7 square inches.
 Weight, 162 pounds = 51.5 pounds per cubic foot.
 Rate of growth, 12 rings per inch.
 Gauged length, 50".
 The post was convex on the micrometer side.

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Compression.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
7,870	100	0.	0.	Initial load.	
15,740	200	.0027	.....	
23,610	300	.0055	.....	
31,480	400	.0084	.....	
39,350	500	.0111	.....	
47,220	600	.0140	.....	
55,090	700	.0170	.....	
62,960	800	.0197	.....	
70,830	900	.0225	.....	
78,700	1,000	.0253	.....	
7,870	100	.....	0.	
84,440	1,200	.0310	.....	
110,180	1,400	.0367	.....	
125,920	1,600	.0422	.....	
141,660	1,800	.0480	.....	
157,400	2,000	.0537	.....	
7,870	1000006		} E = 1,789,000 pounds per square inch.
173,140	2,200	.0596	.....	
188,880	2,400	.0659	.....	
204,620	2,600	.0720	.....	
220,360	2,800	.0784	.....	
236,100	3,000	.0850	.....	
7,870	100	.....	.0033
251,840	3,200	.0935	.....	
267,580	3,400	.1014	.....	
283,320	3,600	.1114	.....	
299,060	3,800	.1249	.....	
314,800	4,000	.1545	.....	
7,870	1000196	Ultimate strength.	
318,100	4,042	.....	.....

Fibers crushed at a knot three-eighths inch diameter 2 feet from the end of the post.

No. 1421.



Sectional area, 97.22 square inches.
 Weight, 341½ pounds = 57.2 pounds per cubic foot.
 Rate of growth, 7 rings per inch.
 Gauged length, 50''.

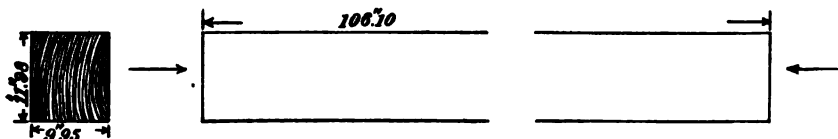
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
9,722	100	0.	0.	Initial load.
19,444	200	.0026	.....
29,166	300	.0053	.....
38,888	400	.0080	.....
48,610	500	.0110	.....
58,332	600	.0140	.....
68,054	700	.0170	.....
77,776	800	.0201	.....
87,498	900	.0231	.....
97,220	1,000	.0266	.....
9,722	100	.....	.0004
116,664	1,200	.0320	.....
136,108	1,400	.0381	.....
155,552	1,600	.0443	.....
174,996	1,800	.0505	.....
194,440	2,000	.0567	.....
9,722	100	.....	.0014
213,884	2,200	.0634	.....
233,328	2,400	.0700	.....
252,772	2,600	.0766	.....
272,216	2,800	.0838	.....
291,660	3,000	.0919	.....
9,722	100	.....	.0039
311,104	3,200	.0990	.....
330,548	3,400	.1080	.....
349,992	3,600	.1193	.....
369,436	3,800	.1356	.....
388,880	4,000	.1680	.....
9,722	100	.....	.0220
411,200	4,230	.....	.....

E = 1,718,000 pounds per square inch.

Ultimate strength.

Fibers crushed at knots one-half inch diameter 32 inches from the end of the post.

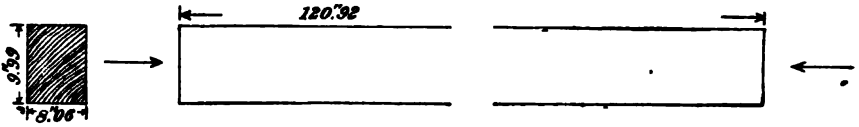
No. 1422.



Sectional area, 119.2 square inches.
 Weight, 415½ pounds=56.8 pounds per cubic foot.
 Rate of growth, 14 rings per inch.
 Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
11,920	100	0.	0.	Initial load.
23,840	200	.0025	.....
35,760	300	.0051	.....
47,680	400	.0080	.....
59,600	500	.0109	.....
71,520	600	.0140	.....
83,440	700	.0170	.....
95,360	800	.0201	.....
107,280	900	.0231	.....
119,200	1,000	.0260	.....
11,920	100	.....	.0003
143,040	1,200	.0322	.....
166,880	1,400	.0384	.....
190,720	1,600	.0446	.....
214,560	1,800	.0511	.....
238,400	2,000	.0581	.....
11,920	1000014		} E = 1,875,000 pounds per square inch.
262,240	2,200	.0639	.....
286,080	2,400	.0706	.....
309,920	2,600	.0772	.....
333,760	2,800	.0844	.....
357,600	3,000	.0925	.....
11,920	100	.....	.0031
381,440	3,200	.0992	.....
405,280	3,400	.1084	.....
429,120	3,600	.1181	.....
452,960	3,800	.1293	.....
476,800	4,000	.1515	.....
11,920	1000117	Ultimate strength.
500,300	4,197	.....	.....

Fibers crushed at a knot three-eighths inch diameter 30 inches from the end of the stick.



Sectional area, 79.92 square inches.
 Weight, 291 pounds=52 pounds per cubic foot.
 Rate of growth, 9 rings per inch.
 Gauged length, 50''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
7,992	100	0.	0.	Initial load.
15,984	200	.0041	.....
23,976	300	.0082	.....
31,968	400	.0120	.....
39,960	500	.0158	.....
47,952	600	.0195	.....
55,944	700	.0230	.....
63,936	800	.0265	.....
71,928	900	.0300	.....
79,920	1,000	.0336	.....
7,992	100	.....	.0015
95,904	1,200	.0408	.....
111,888	1,400	.0481	.....
127,872	1,600	.0554	.....
143,856	1,800	.0631	.....
159,840	2,000	.0715	.....
7,992	1000040	} E=1,407,000 pounds per square inch.
175,824	2,200	.0798	.....
191,808	2,400	.0880	.....
207,792	2,600	.0981	.....
223,776	2,800	.1123	.....
239,760	3,000	.1225	.....
7,992	1000120	} Ultimate strength.
255,744	3,200	.1421	.....
271,728	3,400	.1806	.....
295,500	3,697	

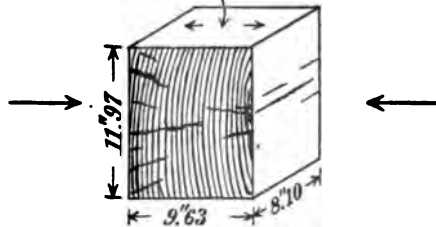
Fibers crushed at a group of knots 4 feet from the end of the post. The knots range from one-fourth inch to 1 inch diameter, and were four in number.

Compression of a sample taken from the middle of the length of post No. 1422.

Loads applied across the grain in a radial direction, or parallel to the medullary rays of the wood.

No. 1424.

Gauged length



Sectional area, $11'' .97 \times 8'' .10 = 96.96$ square inches.
Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
1,939	20	0.	0.	Initial load.
3,878	40	.0009	.....
5,817	60	.0017	.....
7,756	80	.0025	.....
9,696	100	.0032	.....
1,939	20	.....	.0004
11,635	120	.0036	.....
13,574	140	.0043	.....
15,513	160	.0049	.....
17,452	180	.0054	.....
19,392	200	.0060	.....
1,939	20	.....	.0005
21,331	220	.0065	.....
23,270	240	.0070	.....
25,209	260	.0075	.....
27,148	280	.0082	.....
29,088	300	.0088	.....
1,939	20	.....	.0007
31,027	320	.0091	.....
32,966	340	.0099	.....
34,905	360	.0105	.....
36,844	380	.0112	.....
38,784	400	.0118	.....
1,939	20	.....	.0009
40,723	420	.0121	.....
42,662	440	.0129	.....
44,601	460	.0137	.....
46,540	480	.0143	.....
48,480	500	.0151	.....
1,939	20	.....	.0014
50,419	520	.0156	.....
52,358	540	.0163	.....
54,297	560	.0171	.....
56,236	580	.0178	.....
58,176	600	.0186	.....
1,939	20	.....	.0020
60,115	20	.....	.0011
62,054	620	.0194	.....
63,993	640	.0204	.....
65,932	660	.0214	.....
67,872	680	.0225	.....
67,872	700	.0236	.....
67,872	700	.0255	.....
67,872	700	.0266	.....
1,939	20	.....	.0051
67,872	20	.....	.0035
69,811	700	.0250	.....
71,750	720	.0268	.....
73,689	740	.0281	.....
75,628	760	.0292	.....
75,628	780	.0305	.....

E = 210,000 pounds per square inch.

After 1/4 hour rest.

After 5 minutes.
After 10 minutes.

After 15 minutes.

No. 1424—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
77,568	800	.0828		
1,939	20	.....	.0062	
79,507	820	.0842		
81,446	840	.0876		
83,385	860	.0899		
85,324	880	.0431		
87,264	900	.0461		
	900	.0567		
1,939	20	.....	.0151	After 5 minutes.
	20	.....	.0123	After 5 minutes.
	20	.....	.0118	After 8 minutes.
9,696	100	.0140		
19,392	200	.0173		
29,088	300	.0210		
38,784	400	.0250		
48,480	500	.0298		
58,176	600	.0353		
67,872	700	.0418		
77,568	800	.0485		
	800	.0524		After 5 minutes.
	800	.0576		After 15 minutes.
1,939	20	.....	.0207	
77,568	800	.0569		
87,264	900	.0634		
89,203	920	.0675		
91,142	940	.0719		
93,081	960	.0760		
95,020	980	.0811		
96,960	1,000	.0912		
	1,000	.1090		After 5 minutes.
106,656	1,100	.15		Moisture shows on end of stick.
116,352	1,200	.27		
126,048	1,300	.42		
135,744	1,400	.58		
145,440	1,500	.72		
155,136	1,600	.....		Ultimate strength.

Sustained the maximum load one-half minute then failed rapidly under diminished loads, by the stick yielding rapidly, splitting along the grain.

CHEMICAL ANALYSES OF STEEL AND CAST IRON.



CHEMICAL ANALYSES.
STEELS FROM SPRINGFIELD ARMORY.

Tension test number.	Description.	Marks.	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Nickel.	Remarks.
		1	0.362	0.313	0.276	0.054	0.063	0.230		
		2	0.502	0.300	0.223	0.052	0.065	0.050		30 per cent of surface blued.
		3	0.284	0.580	0.023	0.106	0.057	0.150		45 per cent of surface blued.
		4	0.375	0.439	0.209	0.102	0.057	0.150		Uniformly blued.
		5	0.176	0.706	0.021	0.100	0.052	0.042		Nearly uniformly blued.
		6	0.423	0.828	0.197	0.049	0.073	0.050		Uniformly blued.
		32	0.887	0.940	0.116	0.090	0.062			50 per cent of surface blued.
		28	0.516	0.489	0.126	0.050	0.107			Attacked slowly by dilute sulphuric acid.
		7453	0.511	0.814	0.301	0.040	0.121	0.021		Attacked rapidly by dilute sulphuric acid.
		7458	0.511	0.871	0.045	0.045				Taken 10" from breech end.
5399	From rifle barrel that burst while firing.	45	0.357	0.763	0.165	0.020	0.023	0.050		Taken 1" to 2" from breech end.
5401	Nickel steel for rifle barrels.	47	0.395	0.677	0.124	0.025	0.023	0.047	3.97	
5520	Nickel steel for rifle barrels.	58-2	0.707	0.325	0.186	0.030	0.041	0.040	3.170	
5521	For receivers of rifles.	59-3	0.837	0.352	0.116	0.042	0.064	0.040	8.287	
	For bands.		0.217	1.284	0.027	0.142	0.066			
			0.170	1.007	0.017	0.140	0.055			

STEEL AND CAST IRON.

Ten- sion test num- ber.	Description.	Marks.	Carbon.		Manga- nese.	Silicon.	Sulphur.	Phos- phorus.	Copper.
			Total.	Graph- itic.					
	Steel castings for 12" gun lift carriage.....	{ 12 C, F C } { 12 M } { 36 M, A, C }			0.630	0.240	0.035	0.035	0.000
	.....do.....	{ 36 M, A, C }			0.665	0.346	0.034	0.033	0.067
	.....do.....	{ 36 M, A, C }			0.610	0.246	0.030	0.033	0.061
5464	Cast iron with alloy.....	.....	2.971	2.037	0.456	1.722	0.090	0.578	0.000
5465	.....do.....	.....	2.636	1.666	0.438	0.865	0.150	0.534	0.000
5466	.....do.....	.....	2.795	2.394	0.445	1.220	0.093	0.569	0.000
	10" round shot (old).....	.....	3.136	2.990	0.515	2.865	0.015	0.436	.....

STEEL USED IN CONSTRUCTION OF ROCK ISLAND BRIDGE.

Heat No.	Description.	Manufacturers.	Location in bridge.	Carbon.	Manganese.	Silicon.	Phosphorus.
1543	Coupon. Cast steel	Phoenix Iron Co., Phoenixville, Pa.	Draw roller wheel	0.464	0.348	0.136	0.055
4384	15" x 6" x 1 1/2" angle	do	Solid floor trough	0.213	0.565	0.15	0.024
2683	6" x 6" x 1 1/2" angle	do	do	0.260	0.313	0.019	0.028
2712	15" x 130" channel	do	do	0.383	0.451	0.014	0.005
3104	15" x 117" I-beam	do	do	0.327	0.307	0.011	0.012
3080	4" x 4" x 1/2" angle	do	do	0.327	0.315	0.022	0.025
2703	6" x 6" x 1 1/2" angle	do	do	0.240	0.292	0.022	0.020
2790	32" x 34" x 3/4" plate	do	do	0.188	0.437	0.015	0.020
1744	15" x 11" x 1 1/2" angle	do	do	0.313	0.468	0.011	0.058
4337	4" x 4" x 1 1/2" angle	do	do	0.292	0.401	0.017	0.026
3100	6" x 6" x 1 1/2" angle	do	do	0.340	0.413	0.017	0.030
4250	15" x 117" I-beam	do	do	0.238	0.440	0.019	0.073
1696	5" x 5" x 3/4" angle	do	do	0.211	0.411	0.019	0.041
1621	5" x 3" x 1/2" angle	do	do	0.266	0.284	0.017	0.037
3777	4" x 3" flat 1/2" angle	do	do	0.200	0.503	0.010	0.050
1618	5" x 3" x 1 1/2" angle	do	do	0.201	0.491	0.019	0.026
4288	5" x 3" x 1 1/2" angle	do	do	0.217	0.580	0.016	0.055
3180	4" x 3" x 1 1/2" angle	do	do	0.181	0.387	0.016	0.050
1719	6" x 4" x 1 1/2" angle	do	do	0.260	0.581	0.019	0.018
4318	do	do	do	0.239	0.400	0.022	0.018
2783	do	do	do	0.250	0.477	0.017	0.020
4350	3" x 3" x 3/4" angle	do	do	0.246	0.592	0.024	0.060
1720	4" x 3" x 1 1/2" angle	do	do	0.155	0.402	0.018	0.016
2707	15" x 10" x 1 1/2" angle	do	do	0.142	0.474	0.022	0.013
4356	do	do	do	0.205	0.350	0.022	0.067
4358	do	do	do	0.200	0.542	0.020	0.068
3193	6" x 6" x 1 1/2" angle	do	do	0.120	0.350	0.008	0.020
1741	do	do	do	0.155	0.419	0.018	0.052
4307	18" x 1 1/2" plate	do	do	0.100	0.423	0.010	0.016
3199	do	do	do	0.105	0.272	0.010	0.049
3198	do	do	do	0.220	0.348	0.016	0.071
1712	18" x 3/4" plate	Carbon Steel Co., Pittsburgh, Pa.	do	0.185	0.484	0.014	0.072
2792	66" x 1/2" plate	do	Center bracing ties	0.264	0.369	0.023	0.072
2654	20" x 1/2" plate	do	Solid floor rail plates	0.270	0.392	0.011	0.068
2699	20" x 1/2" plate	do	do	0.291	0.451	0.010	0.071
2696	14" x 3/4" plate	do	do	0.279	0.360	0.011	0.077
2652	26" x 3/4" plate	do	do	0.279	0.360	0.011	0.077
2654	do	do	do	0.378	0.450	0.011	0.074
2658	20" x 1/2" plate	do	Solid floor rail plates				
2679	36" x 1/2" plate	do	R. R. stringers web				

Steel used in construction of Rock Island Bridge—Continued.

Heat No.	Description.	Manufacturers.	Location in bridge.	Carbon.	Manganese.	Silicon.	Phosphorus.
2892	25" x 1" plate.....	Carbon Steel Co., Pittsburg, Pa.	Fillers	0.180	0.309	0.010	0.070
2969	33" x 8" plate.....	do	Top chord covers.....	0.140	0.291	0.014	0.068
2961	26" x 3" plate.....	do	R. R. stringers web.....	0.174	0.278	0.010	0.065
3018	23" x 3" plate.....	do	Bottom chord.....	0.226	0.442	0.013	0.065
2923	50" x 1" plate.....	do	Portal.....	0.161	0.450	0.013	0.071
3038	19" x 1" plate.....	do	End posts.....	0.171	0.478	0.014	0.065
3029	14 1/2" x 1" plate.....	do	Bot. chord reinforces web.....	0.242	0.451	0.013	0.066
3075	14 1/2" x 1" plate.....	do	Lower chord reinforces web.....	0.186	0.478	0.020	0.071
3041	19" x 1" plate.....	do	Main hanger posts.....	0.157	0.466	0.023	0.072
3096	8 1/2" x 1" plate.....	do	Portal webs.....	0.185	0.450	0.015	0.070
3104	24 1/2" x 1" plate.....	do	Roadway floor.....	0.184	0.451	0.018	0.072
3515	24" x 1" plate.....	do	Top chord pin plates.....	0.203	0.453	0.012	0.046
3086	60" x 1" plate.....	do	Bedplates.....	0.224	0.362	0.012	0.015
3434	48 1/2" x 1" plate.....	do	R. R. floor beams.....	0.194	0.360	0.010	0.063
3320	19" x 1" plate.....	do	Pin plates int. posts.....	0.218	0.407	0.012	0.067
3444	25 1/2" x 1" plate.....	do	Top chord battens.....	0.198	0.449	0.038	0.054
3450	30 1/2" x 1" plate.....	do	R. R. floor beams.....	0.181	0.433	0.013	0.064
3504	34 1/2" x 1" plate.....	do	Roadway floor beams.....	0.135	0.404	0.012	0.067
3196	24 1/2" x 1" plate.....	do	End post webs.....	0.161	0.313	0.011	0.068
3226	11 1/2" x 1" plate.....	do	Portal gussets.....	0.183	0.391	0.022	0.042
3247	21 1/2" x 1" plate.....	do	Bot. chord pin plates.....	0.186	0.408	0.034	0.065
11531	24" x 1" plate.....	Central Iron Works, Harrisburg, Pa.	Web plates end post.....	0.385	0.427	0.026	0.040
7398	38" x 3" plate.....	do	R. R. stringers web.....	0.372	0.358	0.014	0.030
12132	15" x 1" plate.....	do	R. R. stringer web.....	0.390	0.431	0.020	0.050
10083	36" x 1" plate.....	do	R. R. stringer web.....	0.437	0.480	0.011	0.070

STEEL WIRE ROPE
FROM
BOSTON NAVY YARD.



STEEL WIRE ROPE.

Four types of ropes are represented, designated as types A, B, C, and D, and one sample of rope of annealed wire.

The following table shows the principal elements of each type and size of rope.

Each rope has 6 strands. The wires were galvanized, excepting the annealed rope.

Number of test.	Marks.	Wires.		Sectional area.	Tensile strength.	
		Total number.	Mean diameter.		Total.	Per square inch.
8537	Type A, 2 $\frac{1}{2}$ " circ	108	<i>Inch.</i> 0.0581	<i>Sq. inch.</i> 0.2862	<i>Pounds.</i> 47,980	<i>Pounds.</i> 167,640
8538	do	108	.0581	.2862	48,700	170,160
8529	Type B, 1" circ	66	.0221	.0253	5,080	200,790
8530	Type B, 1 $\frac{1}{4}$ " circ	66	.0301	.0470	7,460	158,720
8532	Type B, 1 $\frac{1}{2}$ " circ	72	.0320	.0579	10,000	172,710
8533	Type B, 2" circ	72	.0424	.1015	18,980	188,990
8536	Type B, 2 $\frac{1}{2}$ " circ	72	.0580	.1901	34,420	181,060
8540	Type B, 3" circ	72	.0640	.2318	39,960	172,390
8541	Type B, 4" circ	84	.0821	.4444	77,960	175,430
8534	Type C, 2 $\frac{1}{2}$ " circ	90	.0374	.0990	18,450	186,360
8539	Type C, 3" circ	90	.0521	.1917	37,400	196,100
8531	Type D, 1 $\frac{1}{2}$ " circ	114	.0311	.0866	5,410	62,470
8535	Annealed, 2 $\frac{1}{2}$ " circ	72	.0459	.1188	12,420	104,550

The samples were prepared for testing with eye splices at the ends.

Elongations were measured, on those ropes with the smaller wires, with a common steel scale, and on those with larger wires with a micrometer.

In general, wire ropes behave in a manner similar to hemp and manila cordage. The full effect on the elongation of the rope is not immediately developed upon the application of the load, additional stretch continuing for an interval of time. Upon release from load the full resilience is sluggishly reached.

Specimen No. 8539, type C, 3" circumference, was loaded five times and the elongations measured on each occasion. The effects of each series of loads is shown in the following table.

Under the fifth loading the ratio of stress to strain, or apparent modulus of elasticity, was 21,161,000 pounds per square inch.

Elongations in gauged length of 30".										
Applied loads.	First loading.		Second loading.		Third loading.		Fourth loading.		Fifth loading.	
	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
Pounds.										
1,000	0.		0.		0.		0.		0.	
2,000	.0161	0.0161	.0100	0.0100	.0094	0.0094	.0090	0.0090	.0081	0.0081
3,000	.0300	0.0139	.0196	0.0096	.0179	0.0085	.0175	0.0085	.0160	0.0079
4,000	.0419	0.0119	.0279	0.0083	.0261	0.0082	.0252	0.0077	.0234	0.0074
5,000	.0520	0.0101	.0355	0.0076	.0334	0.0073	.0324	0.0072	.0305	0.0071
6,000	.0634	0.0114	.0430	0.0075	.0407	0.0073	.0396	0.0072	.0375	0.0070
7,000	.0722	0.0088	.0505	0.0075	.0480	0.0073	.0470	0.0074	.0447	0.0072
8,000	.0810	0.0088	.0580	0.0075	.0556	0.0076	.0543	0.0073	.0523	0.0076
9,000	.0915	0.0105	.0652	0.0072	.0625	0.0069	.0617	0.0074	.0594	0.0071
10,000	.1019	0.0104	.0730	0.0084	.0699	0.0074	.0689	0.0072	.0665	0.0071
11,000			.0821	0.0085	.0772	0.0073				
12,000			.0923	0.0102	.0843	0.0071				
13,000			.1014	0.0081	.0919	0.0070				
14,000			.1114	0.0100	.1001	0.0082				
15,000			.1222	0.0108	.1072	0.0071				
16,000					.1175	0.0103				
17,000					.1285	0.0110				
18,000					.1405	0.0120				
19,000					.1531	0.0126				
20,000					.1689	0.0158	.1460			
21,000							.1577	.0117		
22,000							.1747	.0170		
23,000							.1914	.0167		
24,000							.2076	.0162		
25,000							.2251	.0175		

The amount of zinc on the galvanized wires and chemical composition of the steel wires was found to be—

Description.	Chemical composition.			
	Zinc.	Carbon.	Manganese.	Silicon.
	Per cent.	Per cent.	Per cent.	Per cent.
Type A, 2 1/2" circ.....	0.70	0.345	0.870	0.171
Type B, 1" circ.....	1.50	0.330	0.525	0.070
Type B, 1 1/2" circ.....	4.20	0.411	0.530	0.030
Type B, 1 3/4" circ.....	1.10	0.419	0.840	0.137
Type B, 2" circ.....	1.40	0.530	0.605	0.025
Type B, 2 1/2" circ.....	0.48	0.520	0.750	0.314
Type B, 3" circ.....	0.85	0.530	0.600	0.021
Type B, 4" circ.....	0.52	0.545	0.710	0.211
Type C, 2 1/2" circ.....	1.05	0.400	1.050	0.080
Type C, 3" circ.....	0.54	0.545	0.850	0.014
Type D, 1 1/2" circ.....	4.10	0.040	0.500	0.020
Annealed, 2 1/2" circ.....		0.790	0.454	0.106

No. 8529.

1" Type B.

Diameter, ".33; circumference, 1".05.

Six strands, 11 wires each.

Jute core.

Each strand has a cotton center of 10 threads.

Lay, one turn in 2".6.

Sectional area of wires, 0.0253 square inch.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	
100		0.	0.	Initial load.
200		.05		
300		.08		
400		.10		
500		.13		
600		.15		
800		.18		
1,000		.24		
1,200		.27		
1,400		.33		
1,600		.36		
1,800		.40		
2,000		.43		
100			.18	
2,200		.45		
2,400		.50		
2,600		.54		
2,800		.57		
3,000		.59		
100			.25	
3,200		.63		
3,400		.66		
3,600		.70		
3,800		.74		
4,000		.80		
100			.40	
4,200		.86		
4,400		.90		
4,600		1.02		
4,800		1.11		
5,000		1.40		
100			.92	
5,080	200,790			Tensile strength.

Parted 3 strands at the splice.

No. 8530.

1 $\frac{1}{4}$ " Type B.

Diameter, ".44; circumference, 1".35.

Six strands, 11 wires each.

Each strand has a cotton center of 16 threads.

The rope has a hemp core.

Lay, one turn in 3".58.

Sectional area of wires, .0470 square inch.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inches.	Inch.	
200		0.	0.	Initial load.
400		.04		
600		.07		
800		.09		
1,000		.13		
1,400		.16		
1,800		.21		
2,000		.24		
200			.08	
2,400		.27		
2,800		.31		
3,000		.33		
3,400		.39		
3,800		.42		
4,000		.45		
200			.18	
4,400		.51		
4,800		.58		
5,000		.61		
5,400		.67		
5,800		.75		
6,000		.80		
200			.44	
6,400		.93		
6,800		1.07		
7,000		1.16		
7,400		1.52		
7,460	168,720			Tensile strength.

Parted 1 strand 19" from splice.

No. 8531.

1½" Type D.
 Diameter, ".48; circumference, 1".48.
 Six strands, 19 wires each.
 Hemp core.
 Lay, one turn in 4".15.
 Sectional area of wires, 0.0866 square inch.
 Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inches.	Inch.	
200	0.	0.	Initial load.
1,00006	.....
2,00010	.....
3,00016	.....
4,00033	Tensile strength.
20021	
5,000	1.19	.....
20099	
5,400	1.90	.....
5,410	82,470	

Parted 3 strands 9" from splice.

No. 8532.

1½" Type D.
 Diameter, ".49; circumference, 1".55.
 Six strands, 12 wires each.
 Each strand has a hemp center with a wire in the hemp. The rope has a hemp core.
 Lay, one turn in 3".85.
 Sectional area of wire, 0.0579 square inch.
 Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inches.	Inch.	
200	0.	0.	Initial load.
1,00003	.....
2,00009	.....
3,00015	.....
4,00021	Tensile strength.
20006	
5,00027	.....
6,00040	.....
20012	
7,00049	.....
8,00062	.....
20027	
9,00080	.....
10,000	172,710	1.22	.....

Parted 1 strand at end of the splice.

No. 8533.

2" Type B.

Diameter, ".66; circumference, 2".

Six strands, 12 wires each.

Each strand has a hemp center of 6 threads.

The rope has a hemp core.

Lay, one turn in 4".35.

Sectional area of wires, 0.1015 square inch.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	Initial load.
200		0.	0.	
1,000		.07		
2,000		.14		
3,000		.19		
4,000		.24		
200			.18	
5,000		.33		
6,000		.39		
7,000		.45		
8,000		.52		
200			.32	
9,000		.58		
10,000		.63		
11,000		.70		
12,000		.80		
200			.51	
13,000		.89		
14,000		.98		
15,000		1.10		
16,000		1.21		
200			.89	
17,000		1.43		One broken wire in sight.
18,000		1.79		
18,080	188,900			Tensile strength.

Parted 1 strand at end of the splice.

No. 8534.

2 1/4" Type C.

Diameter, ".68; circumference, 2".12.

Six strands, 15 wires each.

Each strand has a hemp center of 7 threads.

The rope has a hemp core of 9 threads.

Lay one turn in 4".70.

Sectional area of wires, 0.0990 square inch.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	
200		0.	0.	Initial load.
1,000		.09		
2,000		.16		
3,000		.22		
4,000		.27		
200			.12	
5,000		.33		
6,000		.37		
7,000		.42		
8,000		.47		
200			.21	
9,000		.51		
10,000		.58		
11,000		.63		
12,000		.68		
200			.33	
13,000		.77		
14,000		.84		
15,000		.92		
16,000		1.06		
200			.62	
17,000		1.22		
18,000		1.45		
18,450	186,360			Tensile strength.

Parted 4 strands 4" from end of splice.

No. 8535.

2 $\frac{1}{4}$ " annealed.

Diameter, ".75; circumference, 2".32.

Six strands, 12 wires each.

Each strand has a hemp center of 7 threads.

The rope has a hemp core of 9 threads.

Lay, one turn in 4".40.

Sectional area of wires, 0.1188 square inch.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inches.</i>	
200		0.	0.	Initial load.
1,000		.19		
2,000		.37		
3,000		.49		
4,000		.64		
200			.39	
5,000		.77		
6,000		.89		
7,000		1.02		
8,000		1.16		
200			.84	
9,000		1.33		
10,000		1.57		
11,000		1.92		
12,000		3.02		
200			2.58	Tensile strength.
12,420	104,550			

Parted 3 strands 12" from the end of the splice.

No. 8536.

2 3/4" Type B.

Diameter, ".91; circumference, 2".74.

Six strands, 12 wires each.

Each strand has a hemp center of 5 threads.

The rope has a hemp core of 12 threads.

Lay, one turn in 7".

Sectional area of wires, 0.1901 square inch.

Gauged length, 50".

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inch.</i>	
200		0.	0.	Initial load.
1,000		.03		
2,000		.05		
3,000		.08		
4,000		.11		
5,000		.15		
6,000		.17		
7,000		.19		
10,000		.23		
200			.08	
12,000		.28		Tensile strength.
14,000		.32		
16,000		.39		
18,000		.44		
20,000		.47		
200			.19	
22,000		.54		
24,000		.63		
26,000		.70		
28,000		.81		
30,000		.94		
200			.48	
32,000		1.08		
34,000		1.30		
34,420	181,060			

Parted 2 strands at the splice.

No. 8537.

2 3/4" Type A, first sample.

Diameter, ".90; circumference, 2".77.

Six strands, 18 wires each.

Strands laid up in two courses of 12 and 6 wires, respectively, with hemp centers of 8 threads.

The rope has a hemp core.

Lay, one turn in 6".9.

Sectional area of wires 0.2862 square inch.

Gauged length, 50'.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
200		0.	0.	Initial load.
1,000		.06		
2,000		.07		
3,000		.09		
4,000		.10		
5,000		.11		
6,000		.12		
8,000		.14		
10,000		.16		
200			.06	
12,000		.18		
14,000		.21		
16,000		.23		
18,000		.25		
20,000		.27		
200			.09	
22,000		.29		
24,000		.33		
26,000		.36		
28,000		.42		
30,000		.44		
200			.15	
32,000		.49		
34,000		.55		
36,000		.57		
38,000		.67		
40,000		.73		
42,000		.79		
44,000		.88		
46,000		.99		
47,880	167,640			Tensile strength.

Parted 2 strands at the splice.

No. 853S.

2 3/4" Type A, second sample.

Diameter, .90; circumference, 2".75.

Six strands, 18 wires each.

Strands laid up in two courses of 12 and 6 wires, respectively, with hemp centers of 8 threads.

The rope has a hemp core.

Lay, one turn in 6".75.

Sectional area of wires, 0.2862 square inch.

Gauged length, 30".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
1,000		0.		Initial load.
2,000		.0073		
3,000		.0142		
4,000		.0211		
5,000		.0273		
1,000			.0084	
6,000		.0343		
7,000		.0408		
8,000		.0475		
9,000		.0543		
10,000		.0615		
1,000			.0128	
1,000			.0124	After 16 hours' rest.
10,000		.0632		
11,000		.0704		
12,000		.0770		
13,000		.0843		
14,000		.0925		
15,000		.1010		
10,000		.0765		
5,000		.0508		
1,000			.0266	
15,000		.1040		
16,000		.1115		
17,000		.1189		
18,000		.1273		
19,000		.1358		
20,000		.1441		
20,000		.1467		After 1 minute.
20,000		.1482		After 2 minutes.
20,000		.1490		After 3 minutes.
20,000		.1497		After 5 minutes.
20,000		.1503		After 8 minutes.
20,000		.1508		After 10 minutes.
19,000		.1463		
19,000		.1463		After 1 minute.
18,000		.1417		
18,000		.1416		Do.
17,000		.1369		Do.
17,000		.1369		Do.
16,000		.1320		Do.
16,000		.1320		Do.
15,000		.1270		Do.
15,000		.1270		Do.
14,000		.1219		Do.
14,000		.1219		Do.
13,000		.1169		Do.
13,000		.1168		Do.
12,000		.1119		Do.
12,000		.1118		Do.
11,000		.1067		Do.
11,000		.1067		Do.
10,000		.1016		Do.
10,000		.1016		Do.
9,000		.0965		Do.
9,000		.0965		Do.
8,000		.0914		Do.
8,000		.0914		Do.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	Pounds.	Inch.	Inch.	
7,000		.0802		After 1 minute.
7,000		.0802		
6,000		.0808		
6,000		.0808		
5,000		.0757		
5,000		.0756		
4,000		.0700		
4,000		.0699		
3,000		.0640		
3,000		.0639		
2,000		.0572		
2,000		.0570		
1,000			.0444	
1,000			.0478	
2,000		.0549			Do.
2,000		.0550		Do.
3,000		.0610		Do.
3,000		.0610		Do.
4,000		.0666		Do.
4,000		.0666		Do.
6,000		.0771		Do.
6,000		.0772		Do.
8,000		.0875		Do.
8,000		.0877		Do.
10,000		.0981		Do.
10,000		.0982		Do.
12,000		.1087		Do.
12,000		.1088		Do.
14,000		.1193		Do.
14,000		.1195		Do.
16,000		.1299		Do.
16,000		.1303		Do.
18,000		.1412		Do.
18,000		.1414		Do.
20,000		.1527		Do.
20,000		.1531		Do.
21,000		.1597		
22,000		.1666		
23,000		.1750		
24,000		.1858		
25,000		.1932		
20,000		.1705		
15,000		.1451		
10,000		.1189		
5,000		.0927		
1,000			.0623	
5,000		.0870		
10,000		.1137		
15,000		.1405		
20,000		.1676		
25,000		.1974		
25,000		.1998		
1,000			.0607	After 3 minutes.
1,000			.0655	
5,000		.0605		
1,000			.0655	Do.
25,000		.20		
26,000		.21		
28,000		.23		
30,000		.25		
32,000		.26		
34,000		.32		
36,000		.36		
38,000		.39		
40,000		.43		
42,000		.46		
44,000		.53		
46,000		.61		Snapping sounds.
48,000		.75		Tensile strength.
48,700	170,160			

Parted 1 strand at the splice.

No. 8539.

3" Type C.

Diameter, .96; circumference, 2".97.

Six strands, 15 wires each.

Strands have hemp centers of 13 threads each.

The rope has a hemp core.

Lay, one turn in 8".30.

Sectional area of wires, 0.1917 square inch.

Gauged length, 30".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	Initial load.
1,000		0.	0.	
2,000		.0161		
3,000		.0300		
4,000		.0419		
5,000		.0520		
5,000		.0536		
1,000			.0159	
6,000		.0634		
7,000		.0722		
8,000		.0810		
9,000		.0915		
10,000		.1019		
1,000			.0305	
2,000		.0405		
3,000		.0501		
4,000		.0584		
5,000		.0660		
6,000		.0735		
7,000		.0810		
8,000		.0885		
9,000		.0957		
10,000		.1041		
11,000		.1126		
12,000		.1226		
13,000		.1319		
14,000		.1419		
15,000		.1527		
15,000		.1556		
1,000			.0497	
2,000		.0591		
3,000		.0676		
4,000		.0758		
5,000		.0831		
6,000		.0904		
7,000		.0977		
8,000		.1053		
9,000		.1122		
10,000		.1196		
11,000		.1269		
12,000		.1340		
13,000		.1416		
14,000		.1498		
15,000		.1569		
16,000		.1672		
17,000		.1782		
18,000		.1902		
19,000		.2028		
20,000		.2186		
1,000			.0745	
2,000		.0835		
3,000		.0920		
4,000		.0997		
5,000		.1069		
6,000		.1141		
7,000		.1215		
8,000		.1288		
9,000		.1362		
10,000		.1434		
9,000		.1374		
8,000		.1307		
7,000		.1239		

No. 8539—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
6,0001167	
5,0001085	.....
4,0001019	.....
3,0000942	.....
2,0000860	.....
1,0000756	
10,0001424	.....
20,0002206	.....
21,0002322	.....
22,0002492	.....
23,0002659	.....
24,0002821	.....
25,0002996	.....
25,0003065	.....
1,0001255	
2,0001286	.....
3,0001415	.....
4,0001489	.....
5,0001560	.....
6,0001630	.....
7,0001702	.....
8,0001778	.....
9,0001849	.....
10,0001920	.....
9,0001864	.....
8,0001796	.....
7,0001729	.....
6,0001656	.....
5,0001581	.....
4,0001506	.....
3,0001430	.....
2,0001354	.....
1,0001249	
28,00035	.....
30,00041	.....
32,00048	.....
34,00056	.....
36,00074	.....
37,400	195,100	.....	.....

After 2 minutes.

Tensile strength.

Parted one strand 6" from the end of the splice.

No. 8540.

3'' Type B.

Diameter, .98 ; circumference, 2''.97.

Six strands, 12 wires each.

Strands have hemp centers of 6 threads each.

The rope has a hemp core.

Lay, one turn in 7''.15.

Sectional area of wires, 0.2318 square inch.

Gauged length, 30''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
1,000		0.	0.	Initial load.
2,000		.0122		
3,000		.0265		
4,000		.0430		
5,000		.0575		
6,000		.0796		
7,000		.0875		
8,000		.1020		
9,000		.1170		
10,000		.1334		
10,000		.1398		
10,000		.1449		
10,000		.1492		
10,000		.1517		
1,000			.0791		After 2 minutes. After 5 minutes. After 10 minutes. After 15 minutes.
2,000		.0804		
3,000		.0950		
4,000		.1038		
5,000		.1121		
6,000		.1202		
7,000		.1278		
8,000		.1357		
9,000		.1438		
10,000		.1515		
1,000			.0811	
1,000			.0763	
1,000			.0750	
10,000		.1516		
10,000		.1536		
11,000		.1625		
12,000		.1715		
13,000		.1820		
14,000		.1934		
15,000		.2077		
1,000			.1007	After 2 minutes.
2,000		.1083		
3,000		.1171		
4,000		.1256		
5,000		.1336		
6,000		.1416		
7,000		.1492		
8,000		.1570		
9,000		.1645		
10,000		.1719		
11,000		.1792		
12,000		.1870		
13,000		.1944		
14,000		.2024		
15,000		.2109		
16,000		.2227		
17,000		.2365		
18,000		.2498		
19,000		.2645		
20,000		.2774		
20,000		.2841		
20,000		.2912		
20,000		.2961		
1,000			.1487	After 2 minutes. After 5 minutes. After 10 minutes.
1,000			.1440	
2,000		.1539		
3,000		.1631		After 3 minutes.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
4,000		1721		
5,000		1805		
6,000		1887		
7,000		1968		
8,000		2045		
9,000		2117		
10,000		2196		
11,000		2270		
12,000		2341		
13,000		2420		
14,000		2494		
15,000		2566		
16,000		2645		
17,000		2716		
18,000		2799		
19,000		2876		
20,000		2963		
20,000		3002		After 5 minutes.
21,000		3109		
22,000		3220		
23,000		3389		
24,000		3531		
25,000		3712		After 2 minutes.
25,000		3823		After 5 minutes.
25,000		3903		
1,000			.2106	
1,000			.2039	After 2 minutes.
2,000		2136		
3,000		2228		
4,000		2316		
5,000		2400		
6,000		2480		
7,000		2561		
8,000		2635		
9,000		2708		
10,000		2783		
11,000		2855		
12,000		2926		
13,000		3000		
14,000		3072		
15,000		3145		
16,000		3220		
17,000		3290		
18,000		3361		
19,000		3440		
20,000		3518		
21,000		3588		
22,000		3669		
23,000		3746		
24,000		3820		
25,000		3910		
1,000			.2127	
26,000		40		
27,000		43		
28,000		45		
29,000		47		
30,000		51		
31,000		55		
32,000		58		
34,000		65		
36,000		76		
38,000		91		
39,960	172,390			Tensile strength.

Parted 2 strands 2'' from the splice.

No. 8541.

4 $\frac{1}{2}$ " Type B.

Diameter, 1".46; circumference, 4".45.

Six strands, 14 wires each.

Strands have hemp centers of 14 threads each.

The rope has a hemp core.

Lay, one turn in 9".65.

Sectional area of wires, 0.4444 square inch.

Gauged length, 30".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inch.</i>	<i>Inch.</i>	
2,000		0.	0.	Initial load.
4,000		.0141		
6,000		.0298		
8,000		.0443		
10,000		.0574		
2,000			.0232	
2,000			.0229	After 2 minutes.
12,000		.0707		
14,000		.0812		
16,000		.0940		
18,000		.1051		
20,000		.1165		
2,000			.0502	
4,000		.0592		
6,000		.0671		
8,000		.0741		
10,000		.0816		
12,000		.0887		
14,000		.0958		
16,000		.1032		
18,000		.1105		
20,000		.1180		
22,000		.1280		
24,000		.1402		
26,000		.1540		
28,000		.1668		
30,000		.1825		
32,000		.2003		
34,000		.2201		
36,000		.2428		
38,000		.2617		
40,000		.2798		
40,000		.2933		After 2 minutes.
40,000		.2999		After 5 minutes.
40,000		.3065		After 10 minutes.
2,000			.1577	
4,000		.1852		
6,000		.1730		
8,000		.1810		
10,000		.1885		
12,000		.1960		
14,000		.2035		
16,000		.2111		
18,000		.2185		
20,000		.2261		
22,000		.2335		
24,000		.2409		
26,000		.2487		
28,000		.2566		
30,000		.2648		
32,000		.2725		
34,000		.2805		
36,000		.2890		
38,000		.2979		
40,000		.3078		
40,000		.3086		After 2 minutes.
2,000			.1623	
44,000		.35		
48,000		.41		
52,000		.47		
56,000		.52		
60,000		.64		

No. 8541—Continued.

Applied loads.		In gauged length.		Remarks.	
Total.	Per square inch.	Elongation.	Set.		
Pounds.	Pounds.	Inch.	Inch.		
64,000		.73		Stress released to the initial load, a new gauged length of 30' laid off on the rope and micrometer observations renewed, setting the micrometer at zero reading.	
68,000		.85			
72,000		1.02			
2,000		0.	0.	Initial load.	
4,000		.0082		After 30 minutes	
6,000		.0150			
8,000		.0212			
10,000		.0278			
12,000		.0337			
14,000		.0399			
16,000		.0461			
18,000		.0521			
20,000		.0586			
22,000		.0645			
24,000		.0708			
26,000		.0770			
28,000		.0836			
30,000		.0899			
32,000		.0966			
34,000		.1031			
36,000		.1095			
38,000		.1116			
40,000		.1174			
42,000		.1240			
44,000		.1189			
46,000		.1139			
48,000		.1083			
50,000		.1025			
52,000		.0964			
54,000		.0900			
56,000		.0838			
58,000		.0773			
60,000		.0712			
62,000		.0645			
64,000		.0580			
66,000		.0514			
68,000		.0447			
70,000		.0380			
72,000		.0315			
74,000		.0250			
76,000		.0184			
78,000		.0119			
2,000			.0050	After 16 hours.	
4,000			.0029		
6,000		.0103			
8,000		.0168			
10,000		.0225			
12,000		.0284			
14,000		.0345			
16,000		.0406			
18,000		.0467			
20,000		.0525			
22,000		.0584			
24,000		.0634			
26,000		.0480			
28,000		.0421			
30,000		.0360			
32,000		.0294			
34,000		.0228			
36,000		.0165			
38,000		.0103			
40,000			.0039		
					Micrometer removed.
					Measurements resumed on first gauged length.
72,000		1.08			Tensile strength.
74,000		1.13			
76,000		1.20			
77,960	175,430				

Parted 1 strand at the end of the splice.

STEEL WIRE ROPE.

TABLATION OF STEEL WIRE ROPE FROM BOSTON NAVY-YARD.

No. of test.	Marks.	Diam-eter.	Circum-ference.	Strands and core.	Description of strands.	Lay, one turn in—	Tensile strength.	Parted.
8529	1" Type B...	<i>Inches.</i> 0.33	1.05	6 strands and jute core.....	11 wires each, with cotton center of 10 threads.	<i>Inches.</i> 2.6	<i>Pounds.</i> 5,080	3 strands at the splice.
8530	1½" Type B...	.44	1.35	6 strands and hemp core.....	11 wires each, with cotton center of 16 threads.	3.58	7,460	1 strand 10" from splice.
8531	1½" Type D	.48	1.48	.....do.....	19 wires each.....	4.15	5,410	3 strands 9" from splice.
8532	1½" Type B...	.49	1.55	.....do.....	12 wires each, with hemp center, and a wire in the hemp.....	3.85	10,000	1 strand at end of the splice.
8533	2" Type B...	.66	2	.....do.....	12 wires each, with hemp center of 6 threads.	4.35	18,980	Do.
8534	2¼" Type C...	.68	2.12	6 strands and hemp core of 9 threads.....	15 wires each, with hemp center of 7 threads.	4.70	18,450	4 strands 4" from end of the splice.
8535	2½" annealed	.75	2.32	.....do.....	12 wires each, with hemp center of 7 threads.	4.40	12,420	3 strands 12" from the end of the splice.
8536	2½" Type B...	.91	2.74	6 strands and hemp core of 12 threads.....	12 wires each, with hemp center of 5 threads.	7	34,420	2 strands at the splice.
8537	2½" Type A...	.90	2.77	6 strands and hemp core.....	18 wires each, laid up in two courses of 12 and 6 wires, respectively, with hemp center of 8 threads.	6.9	47,980	Do.
8538	.....do.....	.90	2.75	.....do.....	.....do.....	6.75	48,700	1 strand at the splice.
8539	3" Type C	.96	2.97	.....do.....	15 wires each, with hemp center of 13 threads.	8.30	37,400	1 strand 8" from the end of the splice.
8540	3" Type B	.98	2.97	.....do.....	12 wires each, with hemp center of 6 threads.	7.15	32,960	2 strands 2" from the splice.
8541	4½" Type B...	1.46	4.45	.....do.....	14 wires each, with hemp center of 14 threads.	9.65	77,960	1 strand at the end of the splice.



CORDAGE, MANILA AND HEMP,

FROM

BOSTON NAVY-YARD.



MANILA AND HEMP CORDAGE.

Samples were prepared with eye-splices at the ends which were passed over pins held in the jaws of the testing machine.

The splices were wetted before testing.

The elongations of certain of the ropes were measured, the results of which follow in the details of the tests. All other samples were loaded continuously up to the time of rupture.

Large sets accompany the first loading of new rope.

For the purpose of illustrating the behavior after once loading, the samples were released from stresses, the sets determined, and the elongations measured under both ascending and descending loads.

Confirming earlier tests, the elongation at any given load is dependent upon the previous treatment. If the preceding load was a higher one the length of the specimen will be greater than in the case in which the preceding load was lower than the load at the time of the observation.

This peculiar behavior is attributed to the unequal strains in the different yarns composing the rope, due to their variation in length.

For the purpose of showing the variations in the lengths of the strands and the yarns, several short pieces of rope were unlaidd and measured, as follows:

Rope.	Length of rope.	Length of strands	Mean length of yarns.						
			Outside course.	Second course.	Third course.	Fourth course.	Fifth course.	Sixth course.	Center.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
2½" manila	25	31.25	33.81						31.50
		31.05							
3" manila	20	30.65	27.34						25.98
		25.00							
3¾" manila	25	25.15	34.42						31.81
		25.05							
Core, 25.78	25½	30.90	30.90						32.52
		30.70							
4" manila	25	31.00	31.33						31.40
		30.80							
Core, 25.78	25	30.50	31.82						31.25
		30.48							
5" manila	25	30.52	32.94						31.25
		31.50							
Core, 25.62	25	31.40	32.15						31.25
		31.45							
5" hemp bolt rope	25	31.50	32.80						31.25
		30.45							
7" hemp	25	30.10	35.20						32.85
		30.30							
		31.50							
		31.70							
		31.75							
		31.45							
		30.40							
		30.45							
		30.35							
		31.45							
		31.60							
		31.85							
		32.90							
		33.10							
		33.05							

The maximum and minimum lengths of yarns in the several courses of the different ropes were found to be—

Course.	Maximum and minimum length of yarns.						
	2½" manila.	3" manila.	3½" manila.	4" manila.	5" manila.	5" hemp bolt rope.	7" hemp.
Outside	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
	33.63 34.00	27.00 27.55	34.23 34.70	32.90 35.15	34.75 35.25	33.40 34.05	35.75 37.15
Second					32.45 33.05	32.20 33.65	34.25 36.35
Third					31.55 31.80	31.50 32.70	33.60 35.55
Fourth						31.35 33.45	33.15 34.20
Fifth						31.00 31.5	33.05 33.55
Sixth							32.90 33.10
Center		25.55 27.40	31.70 31.95	32.05 32.80			
Core of rope			30.80 31.20	31.30 31.35	31.60 31.65		

Determinations were made of the percentages of ash and chemical composition of manila and hemp fiber, using material left over from earlier tests, which gave the following results:

Rope.	Composition of ash.							
	Ash.		Iron and al. oxide.	Calcium oxide.	Magne- sium oxide.	Manga- nous oxide.	Potas- sium oxide.	Carbon dioxide.
	<i>Per ct.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Manila.....	1.06	18.28	5.70	12.32	5.14	0.73	44.33	13.50
Hemp, untarred.....	2.56	18.38	33.67	38.55	Trace.	.30	.....	9.18
Hemp, tarred.....	2.77	27.00	35.56	28.16	Trace.	.35	.....	8.92

No. 8582.

15-THREAD MANILA.

Diameter, ".65; circumference, 1".94.
 Three strands, 5 threads each.
 Lay, one turn in 1".12.
 Weight per fathom, 4.5 ounces.
 Length between eye-splices, 6 feet.
 Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	Initial load.
200	0.	0.	1.94	
400	1.88	.....	1.15	
600	3.17	.....	1.09	
800	4.09	.....	1.11	
1,000	4.75	.....	1.06	
200	4.12	.....
1,200	5.10	.....	.....
1,400	5.48	.....	.....
1,600	

Parted one strand 4".5 from splice.

No. 8578.

2" MANILA.

Diameter, ".78; circumference, 2".37.
 Three strands, 13 threads each.
 Lay, one turn in 2".
 Weight per fathom, 12.2 ounces.
 Length between eye-splices, 6 feet 5 inches.
 Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	Initial load.
200	0.	0.	2.37	
400	1.46	.....	.....
600	2.54	.....	.....
800	3.41	.....	.....
1,000	4.10	.....	2.06	
1,500	5.39	.....	.....
2,000	6.41	.....	1.88	
200	5.47	1.96	
2,500	6.96	.....	.....
3,000	7.49	.....	1.83	
200	6.47	.....
3,500	7.90	.....	.....
4,000	8.16	.....	.....
4,500	8.43	.....	.....
5,000	Tensile strength.

Sustained maximum load two minutes, then parted one strand at the splice.

No. 8575.

3" MANILA.

Diameter, 1".13; circumference, 3".50.

Three strands, 21 threads each.

Lay, one turn in 3".

Weight per fathom, 1.70 pounds.

Length between eye-splices, 5 feet, 5 inches.

Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200	0.	0.	3.50	Initial load.
400	0.71	.....	.....
600	1.52	.....	.....
800	2.07	.....	.....
1,000	2.60	.....	3.15	
1,500	3.44	.....	.....
2,000	4.11	.....	3.00	
2,500	4.61	.....	.....
3,000	5.15	.....	2.88	
200	4.19	3.00	
3,500	5.50	.....	.....
4,000	5.72	.....	2.81	
4,500	6.09	.....	.....
5,000	6.40	.....	2.73	
200	4.94	2.87	
5,500	6.63	.....	.....
6,000	6.85	.....	.....
6,500	7.00	.....	.....
7,000	7.12	.....	2.64	
7,500	7.20	.....	.....
8,000	7.32	.....	2.60	
200	6.19	2.73	
8,500	7.51	.....	.....
9,000	7.70	.....	.....
200	6.50	.....
9,500	8.00	.....	.....
10,000	8.18	.....	.....
10,500	Tensile strength.

Parted one strand at the splice.

No. 8574.

3¼" MANILA.

Diameter, 1".22 ; circumference, 3".62.

Four strands, 18 threads each.

Rope has manila core of 6 threads.

Lay, one turn in 3".50.

Weight per fathom, 2.22 pounds.

Length between eye-splices, 6 feet.

Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200		0.	0.	3.62	Initial load.
400		0.78			
600		1.36			
800		1.90			
1,000		2.35		3.50	
1,500		3.27			
2,000		3.97		3.36	
2,500		4.55			
3,000		5.02		3.26	
200			3.72	3.36		After 1 hour.
200			3.65		
3,500		5.40			
4,000		6.00		3.17	
4,500		6.20			
5,000		6.55		3.13	
200			5.20	3.28	
5,500		7.00			
6,000		7.57			
6,500		7.82			
7,000		8.10			
7,500		8.46			
8,000		8.65			
8,500		8.76		2.93	
9,000		8.96		3.02	
200			7.34		
9,500		9.10			
10,000		9.26			
10,500		9.41			
11,000		9.52			
11,500		9.59			
12,000		9.67			
12,500		9.78			
13,000					Tensile strength.

Sustained maximum load three minutes, then parted two strands and the core at the splice.

No. 8571.

4" MANILA.

Diameter, 1".50; circumference, 4".50.

Four strands, 26 threads each.

Rope has manila core of 6 threads.

Lay, one turn in 4".

Weight per fathom, 3.06 pounds.

Length between eye-splices, 6 feet.

Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200	0.	0.	4.50	
40075	.....	.....
600	1.31	.....	.....
800	1.88	.....	.....
1,000	2.25	.....	4.15	
1,500	3.07	.....	.....
2,000	3.71	.....	4.04	
2,500	4.22	.....	.....
3,000	4.60	.....	3.94	
3,500	5.00	.....	.....
4,000	5.31	.....	3.85	
200	4.07	3.98	
4,500	5.79	.....	.....
5,000	6.40	.....	3.75	
5,500	6.80	.....	.....
6,000	7.28	.....	3.66	
7,000	7.68	.....	.....
8,000	8.12	.....	3.57	
9,000	8.50	.....	.....
10,000	8.77	.....	3.48	
200	7.16	3.65	
11,000	9.06	.....	.....
12,000	9.23	.....	3.41	
13,000	9.47	.....	.....
14,000	9.70	.....	.....
15,000	9.98	.....	.....
16,000	Tensile strength.

Sustained maximum load three minutes, then one strand parted 10" from the splice.

No. 8568.

5" MANILA.

Diameter, 1".79; circumference, 5".44.
 Four strands, 40 threads each.
 Rope has manila core of 9 threads.
 Lay, one turn in 4".50.
 Weight per fathom, 4.82 pounds.
 Length between eye-splices, 6 feet 9 inches.
 Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200		0.	0.	5.44	Initial load.
400		.45			
600		.90			
800		1.30			
1,000		1.70		5.28	
1,500		2.42			
2,000		3.00		5.14	
2,500		3.50			
3,000		3.98		5.02	
3,500		4.40			
4,000		4.78		4.93	
4,500		5.10			
5,000		5.43		4.83	
6,000			4.12	4.99	
7,000		5.89			
8,000		6.35			
9,000		6.75			
10,000		7.14		4.53	
11,000		7.50		4.74	
12,000			6.03		
13,000		7.71			
14,000		7.89			
15,000		8.14			
16,000		8.32			
17,000		8.53		4.40	
18,000		8.70			
19,000		8.87			
20,000		8.96			
20,000		9.11		4.29	
20,000		9.29			
20,000		9.37			
20,000			7.55	4.53	
21,000					

Sustained maximum load two minutes, then parted one strand 8" from the splice.

No. 8567.

5½" MANILA.

Diameter, 2".04; circumference, 6".16.

Four strands, 49 threads each.

Rope has manila core of 12 threads.

Lay, one turn in 5".10.

Weight per fathom, 5.88 pounds.

Length between eye-splices, 5 feet.

Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.	
Total.	Per square inch.	Elongation.	Set.			
Pounds.	Pounds.	Inches.	Inches.	Inches.		
200		0.	0.	6.16	Initial load.	
400		.53				
600		1.00				
800		1.43				
1,000		1.80		5.90		
1,500		2.54				
2,000		3.23		5.71		
2,500		3.66				
3,000		4.00		5.60		
3,500		4.42				
4,000		4.85		5.54		
4,500		5.03				
5,000		5.33		5.46		
200			4.00	5.62		After 2 minutes.
200			8.94			
1,000		4.12				
2,000		4.50				
3,000		4.83				
4,000		5.17				
5,000		5.41				
6,000		5.73				
7,000		6.17		5.32		
8,000		6.56				
9,000		6.86				
10,000		7.20		5.16		
200			5.76	5.37		
1,000		5.84				
2,000		6.06				
3,000		6.26				
4,000		6.41				
5,000		6.59				
6,000		6.78				
8,000		6.70				
4,000		6.68				
3,000		6.60				
2,000		6.45				
1,000		6.25				
200			5.81		After 3 minutes.	
200			5.72			
200			5.65			
200			5.59	5.38		
200						
10,000		7.15			After 1 hour.	
11,000		7.42				
12,000		7.63				
13,000		7.78				
14,000		8.00				
15,000		8.27		4.99		
16,000		8.42				
17,000		8.50				
18,000		8.63				
19,000		8.82				
20,000		9.00		5.90		
21,000		9.17				
22,000		9.35				
25,000					Tensile strength.	

Sustained the maximum load one minute, then parted two strands and the core at middle of length.

No. 8542.

7" MANILA.

Diameter, 2".63; circumference, 7".90.
 Four strands, 7³ threads each.
 Rope has manila core of 15 threads.
 Lay, one turn in 6".50.
 Weight per fathom, 9.25 pounds.
 Length between eye-splices, 6 feet.
 Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200		0.	0.	7.90	Initial load.
400		0.58			
600		1.08			
800		1.49			
1,000		1.75			
1,500		2.43			
2,000		2.93		7.45	
2,500		3.37			
3,000		3.83			
3,500		4.05			
4,000		4.37		7.23	
4,500		4.75			
5,000		4.95			
5,500		5.19			
6,000		5.39		7.10	
200			3.68	7.26	
6,000		5.42			
7,000		5.82			
8,000		6.05		6.97	
9,000		6.35			
10,000		6.64			
11,000		6.93			
12,000		7.07		6.80	
13,000		7.33			
14,000		7.45			
15,000		7.75		6.68	
16,000		7.93			
18,000		8.25			
20,000		8.68		6.53	
200			6.53	6.94	
0					
200			5.79		
400		5.36			
600		6.02			
800		6.14			
1,000		6.24			
1,500		6.45			
2,000		6.63			
2,500		6.77			
3,000		6.91			
3,500		7.04			
4,000		7.11			
4,500		7.26			
5,000		7.26			
6,000		7.44			
7,000		7.55			
8,000		7.74			
9,000		7.83			
10,000		7.89			
9,000		7.80			
8,000		7.85			
7,000		7.84			
6,000		7.79			
5,000		7.74			
4,000		7.66			
3,000		7.55			
2,000		7.44			
1,000		7.12			
200			6.52		
41,800					Tensile strength.

Parted two strands 18" from the splice.

No. 8589.

2½" HEMP.

Diameter, ".91; circumference, 2".80.

Three strands, 26 threads each.

Lay, one turn in 2".6.

Weight per fathom, 1.43 pounds.

Length between eye-splices, 6 feet 2 inches.

Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	Initial load.
200		0.	0.	2.80	
400		.80			
600		1.38			
800		1.86			
1,000		2.24		2.50	
1,500		2.87			
2,000		3.33		2.42	
200			2.91	2.46	
2,500		3.63			
3,000		3.94		2.36	
200			3.38	2.42	
3,500		4.17			
4,000		4.27		2.33	
4,500		4.41			
5,000		4.53			
5,500		4.70			
6,000		4.85			
6,490					Tensile strength.

Parted one strand at the splice.

No. 8588.

. 2½" RUSSIA HEMP.

Diameter, ".81; circumference, 2".45.

Four strands, 16 threads each.

Rope has hemp core of 4 threads.

Lay, one turn in 2".37.

Weight per fathom, 1.30 pounds.

Length between eye-splices, 5 feet 8 inches.

Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200		0.	0.	2.45	Initial load.
400		.75			
600		1.40			
800		1.90			
1,000		2.27		2.32	
1,500		3.08		2.25	
2,000		3.61		2.29	
200			3.08		
2,500		4.23			
3,000		4.47		2.21	
200			3.77	2.24	
3,500		4.83			
4,000		5.05		2.17	
4,500		5.32			
5,000		5.56			
5,500		5.91			
5,950					Tensile strength.

Parted two strands and the core 14" from the splice.

No. 8586.

7" HEMP.

Diameter, 2".44; circumference, 7".40.

Three strands, 154 threads each.

Lay, one turn in 6".50.

Weight per fathom, 11.53 pounds.

Length between eye-splices, 5 feet 11 inches.

Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200		0.	0.	7.40	Initial load.
400		.48			
600		.95			
800		1.34			
1,000		1.67		7.28	
1,500		2.31			
2,000		2.86		7.06	
2,500		3.19			
3,000		3.59		6.96	
200			2.98	7.04	
3,500		3.91			
4,000		4.18		6.85	
4,500		4.44			
5,000		4.60		6.79	
5,500		4.78			
6,000		5.00			
7,000		5.32			
8,000		5.60		6.63	
200			4.40	6.82	
9,000		5.92			
10,000		6.27		6.53	
11,000		6.49			
12,000		6.65		6.48	
200			5.42	6.66	
13,000		6.90			
14,000		7.00			
15,000		7.11			
16,000		7.22		6.37	
200			6.01	6.58	
17,000		7.40			
18,000		7.50			
19,000		7.55			
20,000		7.60		6.32	
200			6.12	6.54	
1,000		6.26			
2,000		6.34			
4,000		6.57			
6,000		6.77			
8,000		6.95			
10,000		7.10			
8,000		7.08			
6,000		7.02			
4,000		6.95			
2,000		6.80			
1,000		6.62			
200			6.33		
20,000		7.64			
22,000		7.75			
24,000		7.90			
26,000		8.06			
28,000		8.20			
30,000					Tensile strength.

Sustained load one-half minute, then parted one strand at the splice.

No. 8594.

2½" HEMP BOLT ROPE (TARRED).

Diameter, ".92; circumference, 2".80.

Three strands, 26 threads each.

Lay, one turn in 2".5.

Weight per fathom, 1.36 pounds.

Length between eye-splices, 5 feet 4 inches.

Gauged length, 50".

Applied loads.		In gauged length.			Remarks.
Total.	Per square inch.	Elongation.	Set.	Circumference.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200	0.	0.	2.80	Initial load.
40095	.....	.....
600	1.50	.....	.....
800	1.99	.....	.....
1,000	2.35	.....	2.52	
200	2.10	2.55	
1,500	2.86	.....	.....
2,000	3.30	.....	2.45	
2,500	3.67	.....	.....
3,000	3.97	.....	2.38	
200	3.36	2.44	
3,500	4.28	.....	.....
4,000	4.43	.....	.....
4,500	4.58	.....	.....
5,000	4.75	.....	2.32	
5,500	4.86	.....	.....
6,000	5.00	.....	.....
6,490	Tensile strength.

Parted two strands at the splice.

No. 8593.

3" HEMP BOLT ROPE (TABBED).

Diameter, 1".07; circumference, 3".28.

Three strands, 38 threads each.

Lay, one turn in 2".8.

Weight per fathom, 2.01 pounds.

Length between eye-splices, 6 feet.

Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200		0.	0.	3.28	Initial load.
400		.64			
600		1.13			
800		1.78			
1,000		2.17		2.94	
1,500		2.76		2.86	
2,000		3.36		2.90	
2,200			2.80		
2,500		3.72			
3,000		4.12			
3,500		4.37			
4,000		4.54		2.74	
4,200			3.81	2.80	
4,500		4.79			
5,000		4.93			
5,500		5.07			
6,000		5.20		2.88	
6,200			4.33	2.76	
6,500		5.38			
7,000		5.57			
7,500		5.61			
8,000		5.72			
9,000		5.91			
9,850					Tensile strength.

Parted two strands at the splice.

No. 8592.

5" HEMP BOLT ROPE (TARRED).

Diameter, 1".76; circumference, 5".40.
 Three strands, 101 threads each.
 Lay, one turn in 4".5.
 Weight per fathom, 5.56 pounds.
 Length between eye-splices, 6 feet.
 Gauged length, 50".

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200		0.	0.	5.40	Initial load.
400		.47			
600		1.00			
800		1.25			
1,000		1.53			
200			1.30		
1,500		2.08			
2,000		2.36		4.96	
200			1.88	5.02	
2,500		2.68			
3,000		2.95		4.86	
3,500		3.22			
4,000		3.40		4.77	
200			2.72	4.90	
4,500		3.60			
5,000		3.72		4.73	
5,500		3.82			
6,000		3.96		4.68	
200			3.16	4.83	
6,500		4.11			
7,000		4.23			
7,500		4.31			
8,000		4.39			
8,500		4.42			
9,000		4.50			
9,500		4.55		4.57	
10,000		4.64		4.74	
200			3.63		
11,000		4.75			
12,000		4.84			
13,000		4.96			
14,000		5.10		4.48	
15,000		5.19		4.66	
200			4.04		
16,000		5.37			
17,000		5.40			
18,000		5.49			
19,000		5.55			
20,000		5.67			
21,000		5.70			
22,000		5.80			
23,000		5.88			
24,000		6.00			

Tensile strength.

Parted one strand 14" from the splice.

No. 8597.

RUSSIA HEMP, 1½" DEEP-SEA LINE.

Diameter, ".49; circumference, 1".50.

Three strands, 9 threads each.

Lay, one turn in 1".25.

Weight per fathom, 7.2 ounces.

Not tarred.

Length between eye-splices, 6 feet 6 inches.

Gauged length, 50".

Applied loads.		In gauged length.			Remarks.
Total.	Per square inch.	Elongation.	Set.	Circumference.	
<i>Pounds.</i>	<i>Pounds.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	
200	0.	0.	1.50	Initial load.
400	1.39	.....	.....
600	2.41	.....	1.34	
800	3.10	.....	.....
1,000	3.84	.....	1.31	
200	3.30	1.33	
1,200	4.30	.....	.....
1,400	4.65	.....	.....
1,600	5.04	.....	.....
1,800	5.40	.....	.....
2,000	5.71	1.26	Tensile strength.
200	4.70	1.29	
2,200	6.01	.....	.....

Parted two strands 35" from the splice.

TABULATION OF TENSILE TESTS OF HEMP AND MANILA CORDAGE FROM BOSTON NAVY-YARD.
 Secured at ends by means of pins passing through eye-splices. Splices wetted before testing.
 Length of samples between splices, 5 to 6 feet.

MANILA ROPE.

No. of test.	Nominal size of rope.	Actual circumferences.	Diam. clear.	No. of strands.	Threads per strand.	Threads in core.	Lay, one turn in—	Length.	Weight.	Weight per fathom.	Tensile strength.	Parted.
	Inches.	Inches.	Inches.				Inches.	Fl. In.	Lbs. Oz.	Lbs. Oz.	Pounds.	
8585	6-thread.	0.83	0.27	3	2	.....	0.75	24 6	0 7	0 1.7	586	1 strand 22" from the splice.
8584	9-thread.	1.04	.33	3	3	.....	1.87	24 8	0 11 1/2	0 2.7	890	1 strand 35" from the splice.
8583	12-thread.	1.17	.38	3	4	.....	1.57	24 7	0 15 1/2	0 3.6	1,560	2 strands at the splice.
8582	13-thread.	1.37	.44	3	5	.....	1.12	24 4	1 2 1/2	0 4.5	1,600	1 strand 45" from the splice.
8581	1 1/2	1.50	.47	3	6	.....	1.37	20 7 1/2	1 2 1/2	0 5.5	2,560	1 strand 24" from the splice.
8580	1 1/2	1.66	.64	3	7	.....	1.37	23 6	1 10 0	0 6.6	2,360	1 strand 9" from the splice.
8579	1 1/2	1.94	.65	3	9	.....	1.75	24 2 1/2	2 5 0	0 9.2	3,420	1 strand at the splice.
8578	2	2.37	.78	3	13	.....	2 2 1/2	20 1 1/2	2 8 1/2	0 12.2	5,000	Do.
8577	2 1/2	2.66	.94	3	14	.....	2.50	20 1	3 13 1/2	0	7,240	Do.
8576	3	3.21	1.04	3	18	.....	2.75	23 1 1/2	6 14	1.70 0	9,920	Do.
8575	3	3.50	1.13	3	21	.....	3 50	20 1	5 11	1.70 0	10,500	Do.
8574	3 1/2	3.62	1.22	4	18	6	3 50	23 9 1/2	8 13	2.23 0	13,000	2 strands and core at the splice.
8573	3 1/2	3.95	1.31	4	20	6	3.65	20 4	7 15	2.40 0	13,800	1 strand at middle of length.
8572	3 1/2	4.02	1.34	4	22	6	3.70	20 4	10 8	3.14 0	16,250	2 strands and core at the splice.
8571	4	4.50	1.50	4	26	9	4 25	19 11 1/2	10 2 1/2	3.98 0	16,000	1 strand 10" from the splice.
8570	4 1/2	5.12	1.68	4	33	9	4 50	20 5 1/2	13 9 1/2	4.51 0	18,200	2 strands and core 26" from the splice.
8569	4 1/2	5.30	1.75	4	37	9	4 50	23 10 1/2	17 10 1/2	4.82 0	21,000	2 strands and core 30" from the splice.
8568	5	5.44	1.79	4	40	12	5.10	24 5 1/2	19 10 1/2	5.88 0	25,000	1 strand 8" from the splice.
8567	5 1/2	6.16	2.04	4	49	12	5.10	23 5 1/2	23 0 1/2	5.88 0	25,000	2 strands and core at middle of length.
8542	7	7.90	2.63	4	78	15	6.50	24 5 1/2	37 12	5.95 0	41,800	2 strands 18" from the splice.

HEMP ROPE (TARRED).

8591	1 1/2	1.90	0.61	3	12	.....	1.9	24 0 1/2	3 10 1/2	0 10.7	3,010	1 strand at the splice.
8590	2	2.05	.68	3	16	.....	2.12	23 8 1/2	3 6 1/2	0 13.7	3,810	Do.
8589	2 1/2	2.80	.91	3	26	.....	2.6	23 5	5 0	1.43 0	6,490	Do.
8588	3	3.45	.81	4	16	4	2.37	24 1	5 3 1/2	1.30 0	6,950	2 strands and core 14" from the splice.
8587	{ Manila.	3.05	1.1	3	32	.....	3.75	23 6 1/2	7 2 1/2	1.83 0	7,310	1 strand at the splice.
8586	{ 7	7.40	2.44	3	154	.....	.....	24 9 1/2	47 10	11.53 0	30,000	Do.

Tabulation of tensile tests of hemp and manila cordage from Boston Navy yard—Continued.

HEMP BOLT ROPE (TARRED).

No. of test.	Nominal size of rope.	Actual circumference.	Diam. eter.	No. of strands.	Threads per strand.	Threads in core.	Lay. in—	Length.	Weight.	Weight per fathom.	Tensile strength.	Parted.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>				<i>Inches.</i>	<i>Ft. In.</i>	<i>Lbs. Oz.</i>	<i>Lbs. Oz.</i>	<i>Pounds.</i>	
8596	1½	1.75	0.58	3	10	.....	1.5	20 6½	1 13	0 8.5	2,576	2 strands at the splice.
8595	2	2.25	.73	3	17	.....	2	20 1½	3 2½	0 15	4,360	Do.
8594	2½	2.80	.92	3	26	.....	2.5	19 10¼	4 8	1.26 0	6,490	Do.
8593	3	3.28	1.07	3	38	.....	2.8	20 7¼	6 12	2.01 0	9,850	Do.
8592	5	5.40	1.76	3	101	.....	4.5	23 9¼	22 ¾	5.56 0	24,000	1 strand 14' from the splice.

RUSSIA HEMP. DEEP-SEA LINE (NOT TARRED).

8597	1½	1.50	0.49	3	9	1.25	24 3	1 13½	0 7.2	2,200	2 strands 35' from the splice.
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LINEN SHOT LINES

FOR THE

UNITED STATES LIFE-SAVING SERVICE.



LINEN SHOT LINES.

In taking out the samples for test from the coils it was found that, in drawing the ends from under the sisal straps used for holding the coils in shape, a considerable part of the original twist in the lines was unalaid.

These samples, taken for the most part from the inside ends of the coils, were duplicated with additional samples taken from the same ends of the coils as before, the original twist being carefully retained in the duplicates.

In some of the coils the line immediately at the inside end was slack laid.

No. 4 SHOT LINES.

Diameter, ".13.

Three strands of 4 threads each.

Threads two-ply.

Lay, one turn in $\frac{5}{8}$ " to $\frac{3}{4}$ ".

Tested in 4-foot lengths.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	<i>Lbs. Oz.</i>		<i>Pounds.</i>	
8085	9 10	Inside	412	1 strand at the middle.
8086	9 8	Outside	408	2 strands 6" from pin.
8087	9 9	Inside	404	1 strand at the middle.
8088	9 11	Outside	402	1 strand 7" from pin.
8089	9 10	Inside	398	1 strand 14" from pin.
8090	9 13	do	401	1 strand 22" from pin.
8091	9 12	Outside	421	3 strands at the middle.
8092	10 2	Inside	418	2 strands at pin.
8093	10 4	Outside	430	1 strand 14" from pin.
8094	9 12	Inside	388	1 strand 24" from pin.
8095	10 1	Outside	422	1 strand 12" from pin.
8096	9 15	Inside	387	2 strands 14" from pin.
8097	9 15	Outside	404	1 strand 14" from pin.
8098	9 14	Inside	398	1 strand at middle.
8099	10 2	Outside	449	2 strands 21" from pin.
8100	9 13	Inside	442	1 strand at pin.
8101	9 11	Outside	388	1 strand 16" from pin.
8102	9 14	Inside	405	1 strand 9" from pin.
8103	10 4	Outside	400	1 strand at pin.
8104	9 11	Inside	402	Do.
8105	9 14	do	386	1 strand 8" from pin.
8106	10 1	Outside	386	1 strand 12" from pin.
8107	10 2	Inside	392	1 strand 18" from pin.
8108	9 14	Outside	395	3 strands 18" from pin.
8109	9 14	Inside	382	2 strands 18" from pin.
8110	10 1	Outside	428	3 strands 3" from pin.
8111	10 0	Inside	452	2 strands at pin.
8112	10 3	Outside	412	Do.
8113	9 15	Inside	405	1 strand 22" from pin.
8114	10 1	Outside	420	2 strands at pin.
8115	10 1	Inside	400	2 strands 5" from pin.
8116	10 0	Outside	436	1 strand at the middle.
8117	10 0	Inside	384	1 strand 10" from pin.
8118	10 1	Outside	442	2 strands 5" from pin.
8119	10 0	Inside	260	1 strand 5" from pin.
8119 ^a	10 0	do	338	1 strand 7" from pin.
8120	10 0	Outside	398	1 strand at the middle.
8121	9 13	Inside	270	1 strand 8" from pin.
8121 ^a	9 13	do	367	1 strand 12" from pin.
8122	10 1	Outside	391	2 strands at pin.
8123	9 12	Inside	392	1 strand 15" from pin.
8124	9 15	Outside	402	1 strand 7" from pin.
8125	9 10	Inside	403	2 strands 8" from pin.
8126	9 13	Outside	396	1 strand 15" from pin.
8127	9 11	do	392	1 strand 24" from pin.
8128	9 13	Inside	401	3 strands at pin.
8129	9 13	Outside	376	1 strand 21" from pin.

No. 4 SHOT LINES—Continued.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	<i>Lbs. Oz.</i>		<i>Pounds.</i>	
8130	9 14	Outside.....	397	1 strand 14" from pin.
8131	9 14	Inside.....	384	1 strand 19" from pin.
8132	9 14	Outside.....	412	2 strands 8" from pin.
8133	9 13	Inside.....	389	1 strand 20" from pin.
8134	9 15	Outside.....	379	1 strand 7" from pin.
8135	10 0	Inside.....	392	3 strands 9" from pin.
8136	10 0	Outside.....	399	2 strands 2" from pin.
8137	10 0	Inside.....	384	1 strand at the middle.
8138	10 0	Outside.....	386	1 strand 19" from pin.
8139	9 15	Inside.....	361	1 strand 12" from pin.
8140	10 2	Outside.....	406	1 strand 7" from pin.
8141	10 3	Inside.....	344	1 strand 20" from pin.
8142	10 3	Outside.....	394	1 strand 18" from pin.
8143	10 3	Inside.....	387	1 strand at the middle.
8144	10 1	Outside.....	402	1 strand 21" from pin.
8145	10 1	Inside.....	376	1 strand 14" from pin.
8146	10 2	Outside.....	398	2 strands 17" from pin.
8147	10 2	Inside.....	405	2 strands 16" from pin.
8148	10 4	Outside.....	399	2 strands at the middle.
8149	10 1	Inside.....	404	Do.
8150	9 14	.....do.....	346	1 strand 17" from pin.
8151	9 11	Outside.....	395	1 strand 10" from pin.
8152	9 10	.....do.....	358	1 strand at the middle.
8153	9 11	Inside.....	381	1 strand 9" from pin.
8154	9 14	Outside.....	396	2 strands at the middle.
8155	10 0	.....do.....	384	3 strands 20" from pin.
8156	9 14	Inside.....	361	3 strands 18" from pin.
8157	10 0	Outside.....	342	1 strand 6" from pin.
8158	9 15	Inside.....	402	1 strand at pin.
8159	10 1	Outside.....	396	3 strands 18" from pin.
8160	10 1	Inside.....	382	1 strand 16" from pin.
8161	10 3	Outside.....	384	1 strand 13" from pin.
8162	10 1	Inside.....	386	1 strand 4" from pin.
8163	10 3	Outside.....	402	1 strand at the middle.
8164	10 3	Inside.....	398	3 strands 12" from pin.
8165	10 0	Outside.....	389	1 strand 15" from pin.
8166	9 15	Inside.....	397	2 strands 14" from pin.
8167	10 0	Outside.....	350	1 strand 17" from pin.
8168	10 1	Inside.....	416	1 strand 14" from pin.
8169	9 15	Outside.....	400	3 strands at the middle.
8170	9 18	Inside.....	372	1 strand 3" from pin.
8171	9 14	.....do.....	365	1 strand 10" from pin.
8172	9 14	Outside.....	396	1 strand 17" from pin.
8173	9 14	.....do.....	399	2 strands 3" from pin.
8174	9 13	Inside.....	378	1 strand 5" from pin.
8175	9 14	Outside.....	396	1 strand 8" from pin.
8176	10 0	Inside.....	387	2 strands 2" from pin.
8177	9 15	Outside.....	388	2 strands 13" from pin.
8178	10 1	Inside.....	366	1 strand at pin.
8179	10 0	Outside.....	419	3 strands at pin.
8180	9 10	Inside.....	388	1 strand 6" from pin.
8181	9 10	Outside.....	348	1 strand 14" from pin.
8182	9 11	Inside.....	342	1 strand 17" from pin.
8183	10 0	Outside.....	398	1 strand 14" from pin.
8184	9 11	Inside.....	387	1 strand 17" from pin.

No. 7 SHOT LINES.

Diameter, ".21.
 Three strands of 9 threads each.
 Threads two-ply.
 Lay, one turn in $\frac{1\frac{1}{8}}{16}$ " to $\frac{3}{4}$ ".
 Tested in 4-foot lengths.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	<i>Lbs. Oz.</i>		<i>Pounds.</i>	
7985	20 4	Outside.....	782	1 strand 9" from pin.
7986	20 4	Inside.....	866	1 strand at pin.
7987	20 4	Outside.....	799	Do.
7988	20 8	Inside.....	884	3 strands at pin.
7989	20 4	Outside.....	830	1 strand at middle.
7990	20 0	Inside.....	776	1 strand 4" from pin.
7991	20 8	Outside.....	800	1 strand at middle.
7992	20 8	Inside.....	789	1 strand at pin.
7993	20 4	Outside.....	895	Do.
7994	20 4	Inside.....	580	Do.
7994a	20 4	do.....	798	1 strand 10" from pin.
7995	20 8	Outside.....	846	1 strand 6" from pin.
7996	20 8	do.....	905	1 strand 22" from pin.
7997	20 8	do.....	890	1 strand at middle.
7998	20 0	Inside.....	618	1 strand 24" from pin.
7998a	20 0	do.....	778	1 strand 16" from pin.
7999	20 0	Outside.....	798	1 strand at pin.
8000	20 0	Inside.....	805	1 strand 18" from pin.
8001	20 4	Outside.....	799	1 strand at pin.
8002	20 4	Inside.....	752	3 strands at pin.
8003	20 4	Outside.....	802	1 strand 18" from pin.
8004	20 4	Inside.....	785	1 strand at the middle.
8005	20 0	Outside.....	885	Do.
8006	20 4	Inside.....	798	Do.
8007	20 0	Outside.....	875	1 strand at pin.
8008	20 8	Inside.....	760	1 strand 2" from pin.
8009	20 8	do.....	727	1 strand at pin.
8010	20 8	do.....	747	Do.
8011	20 4	Outside.....	886	1 strand at the middle.
8012	20 4	do.....	910	1 strand at pin.
8013	20 0	Inside.....	805	Do.
8014	20 4	do.....	855	1 strand 14" from pin.
8015	20 8	Outside.....	854	1 strand at pin.
8016	20 4	Inside.....	740	1 strand 16" from pin.
8017	20 8	Outside.....	831	1 strand 18" from pin.
8018	20 8	Inside.....	585	1 strand at pin.
8018a	20 8	do.....	664	2 strands at middle.
8019	20 0	Outside.....	802	1 strand at pin.
8020	20 0	Inside.....	578	1 strand 2" from pin.
8020a	20 0	do.....	795	1 strand at middle.
8021	20 0	Outside.....	818	1 strand 24" from pin.
8022	20 4	Inside.....	742	1 strand at pin.
8023	20 8	Outside.....	802	Do.
8024	20 4	Inside.....	785	1 strand 20" from pin.
8025	20 8	do.....	602	1 strand at pin.
8025a	20 8	do.....	762	2 strands at pin.
8026	20 8	Outside.....	748	1 strand 10" from pin.
8027	20 8	Inside.....	783	1 strand 18" from pin.
8028	20 4	Outside.....	787	1 strand 20" from pin.
8029	20 4	Inside.....	730	1 strand 13" from pin.
8030	20 4	Outside.....	902	1 strand 24" from pin.
8031	20 8	Inside.....	794	1 strand at pin.
8032	20 0	Outside.....	795	Do.
8033	20 4	Inside.....	802	Do.
8034	20 8	Outside.....	804	1 strand 6" from pin.
8035	20 8	Inside.....	890	1 strand at pin.
8036	20 8	do.....	800	3 strands 20" from pin.
8037	20 4	Outside.....	849	1 strand at middle.
8038	20 4	Inside.....	897	Do.
8039	20 8	Outside.....	792	1 strand 22" from pin.
8040	20 4	Inside.....	810	1 strand 24" from pin.
8041	20 8	Outside.....	900	1 strand 15" from pin.
8042	20 4	Inside.....	744	1 strand 18" from pin.
8043	20 8	Outside.....	810	1 strand at pin.
8044	20 8	Inside.....	878	1 strand 12" from pin.
8045	20 4	Outside.....	847	1 strand at middle.
8046	20 8	Inside.....	867	Do.
8047	20 0	do.....	582	1 strand at pin.
8047a	20 0	do.....	755	2 strands at middle.

No. 7 SHOT LINES—Continued.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	<i>Lbs. Oz.</i>		<i>Pounds.</i>	
8048	20 0	Outside	798	1 strand at pin.
8049	20 0	Inside	875	Do.
8050	20 8	Outside	747	1 strand 24" from pin.
8051	20 4	Inside	776	1 strand at pin.
8052	20 0	Outside	724	Do.
8053	20 4	Inside	748	1 strand at middle.
8054	20 4	Outside	800	1 strand at pin.
8055	20 0	Inside	798	Do.
8056	20 8	Outside	780	1 strand at middle.
8057	20 0	Inside	794	1 strand 15" from pin.
8058	20 0	Outside	880	2 strands at pin and 18" from pin.
8059	20 0	Inside	784	1 strand 12" from pin.
8060	20 0	Outside	870	1 strand 4" from pin.
8061	20 0	do	852	1 strand at pin.
8062	20 4	Inside	802	2 strands at pin.
8063	20 0	do	862	1 strand 18" from pin.
8064	20 4	Outside	800	1 strand 8" from pin.
8065	20 4	do	898	1 strand at pin.
8066	20 0	do	823	Do.
8067	20 0	do	756	Do.
8068	20 4	Inside	694	1 strand at middle.
8069	20 4	Outside	852	1 strand at pin.
8070	20 4	Inside	696	Do.
8071	20 0	Outside	672	1 strand 12" from pin.
8072	20 4	Inside	749	1 strand at middle.
8073	20 4	Outside	795	1 strand 24" from pin.
8074	20 0	Inside	735	2 strands at middle.
8075	20 0	Outside	864	1 strand at pin.
8076	20 0	Inside	750	Do.
8077	20 0	Outside	795	1 strand 20" from pin.
8078	20 4	Inside	805	1 strand 6" from pin.
8079	20 0	Outside	792	1 strand 24" from pin.
8080	20 0	do	767	1 strand 2" from pin.
8081	20 0	Inside	687	1 strand 18" from pin.
8082	20 4	Outside	746	1 strand at pin.
8083	20 0	do	902	1 strand at middle.
8084	20 0	Inside	745	1 strand 22" from pin.

No. 7 SHOT LINES—Continued.

Diameter, ".20.
 Three strands of 9 threads each.
 Threads two-ply.
 Lay, one turn in ".82.
 Tested in 4 feet lengths.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. Oz.		Pounds.	
8404	20 3 $\frac{1}{2}$	Outside	753	1 strand at pin.
8405	20 4 $\frac{1}{2}$	do	849	1 strand 15" from pin.
8406	20 5 $\frac{1}{2}$	do	652	1 strand 6" from pin.
8406a	20 5 $\frac{1}{2}$	do	667	1 strand 15" from pin.
8407	20 7 $\frac{1}{2}$	Inside	696	1 strand at pin.
8408	20 9	Outside	780	1 strand 15" from pin.
8409	20 8	do	853	1 strand at pin.
8410	20 11 $\frac{1}{2}$	do	772	1 strand 15" from pin.
8411	20 12	Inside	698	1 strand 2" from pin.
8412	20 10 $\frac{1}{2}$	Outside	798	2 strands at pin.
8413	20 11	do	741	1 strand 15" from pin.
8414	20 11 $\frac{1}{2}$	do	778	1 strand 8" from pin.
8415	20 10	do	754	1 strand at pin.
8416	20 5 $\frac{1}{2}$	Inside	901	1 strand 21" from pin.
8417	20 7 $\frac{1}{2}$	Outside	854	1 strand at pin.
8418	20 8 $\frac{1}{2}$	do	848	Do.
8419	20 6 $\frac{1}{2}$	do	905	2 strands at the pin.
8420	20 11 $\frac{1}{2}$	Inside	782	Do.
8421	20 7	Outside	841	1 strand 15" from pin.
8422	20 7	do	797	1 strand 12" from pin.
8423	20 7	do	846	2 strands 5" from pin.
8424	20 11 $\frac{1}{2}$	do	782	1 strand 5" from pin.
8425	20 11	do	734	1 strand 8" from pin.
8426	20 12 $\frac{1}{2}$	Inside	702	1 strand at the middle.
8427	20 10 $\frac{1}{2}$	do	696	1 strand 5" from pin.
8427a	20 10 $\frac{1}{2}$	do	805	Do.
8428	20 13 $\frac{1}{2}$	Outside	802	1 strand 3" from pin.
8429	20 12	do	853	1 strand at the pin.
8430	20 2	do	786	1 strand 3" from pin.
8431	20 5 $\frac{1}{2}$	do	783	1 strand at the pin.
8432	20 2	do	732	Do.
8433	20 7	do	680	2 strands at the middle.
8434	20 7 $\frac{1}{2}$	do	685	1 strand at the middle.
8434a	20 7 $\frac{1}{2}$	do	702	1 strand 5" from pin.
8435	20 9	do	905	2 strands at the pin.
8436	20 6 $\frac{1}{2}$	do	802	1 strand 6" from pin.
8437	20 10 $\frac{1}{2}$	do	768	1 strand at the pin.
8438	20 10 $\frac{1}{2}$	do	704	Do.
8439	20 1 $\frac{1}{2}$	Inside	636	2 strands 7" from pin.
8439a	20 1 $\frac{1}{2}$	do	732	1 strand 15" from pin.
8440	20 11	Outside	778	1 strand 2" from pin.
8441	20 8 $\frac{1}{2}$	Inside	632	1 strand 10" from pin.
8441a	20 8 $\frac{1}{2}$	do	800	1 strand 18" from pin.
8442	20 10	Outside	804	2 strands at pin.
8443	20 7	do	730	1 strand at pin.
8444	20 10 $\frac{1}{2}$	Inside	685	2 strands 6" from pin.
8444a	20 10 $\frac{1}{2}$	do	808	1 strand 12" from pin.
8445	20 10 $\frac{1}{2}$	Outside	771	1 strand at the pin.
8446	20 13 $\frac{1}{2}$	do	756	2 strands at the middle.
8447	20 8 $\frac{1}{2}$	do	848	1 strand 19" from pin.
8448	20 7	do	826	2 strands at the pin.
8449	20 11	do	798	2 strands 12" from pin.
8450	20 11 $\frac{1}{2}$	do	750	1 strand at the pin.
8451	20 10	Inside	804	Do.
8452	20 11 $\frac{1}{2}$	do	766	2 strands at the pin.
8453	20 11 $\frac{1}{2}$	Outside	885	1 strand at the pin.
8454	20 12 $\frac{1}{2}$	do	799	1 strand 17" from pin.
8455	20 11 $\frac{1}{2}$	do	795	1 strand at the middle.
8456	20 7 $\frac{1}{2}$	do	847	1 strand at the pin.
8457	20 9 $\frac{1}{2}$	do	874	3 strands at the pin.
8458	20 6 $\frac{1}{2}$	do	758	1 strand at the pin.
8459	20 6	do	782	1 strand 19" from pin.
8460	20 11 $\frac{1}{2}$	do	735	1 strand at the middle.
8461	20 11	Inside	638	Do.
8461a	20 11	do	740	1 strand at the pin.
8461b	20 11	do	753	Do.
8461c	20 11	Outside	765	2 strands at the pin.
8462	20 7 $\frac{1}{2}$	do	827	Do.
8463	20 11 $\frac{1}{2}$	do	805	1 strand 10" from pin.

No. 7 SHOT LINES—Continued.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	<i>Lbs. Oz.</i>		<i>Pounds.</i>	
8464	20 7½	Outside.....	802	1 strand at the pin.
8465	20 7½	Inside.....	710	2 strands 6" from pin.
8465a	20 7½	do.....	789	1 strand 18" from pin.
8466	20 10	Outside.....	720	1 strand at the middle.
8467	20 13½	do.....	767	1 strand at pin.
8468	20 12½	Inside.....	686	1 strand at the middle.
8468a	20 12½	do.....	759	1 strand 3" from pin.
8469	20 12½	Outside.....	798	1 strand 22" from pin.
8470	20 13½	do.....	753	1 strand 12" from pin.
8471	20 3½	do.....	748	2 strands 3" from pin.
8472	20 11	do.....	648	1 strand at the middle.
8472a	20 11	do.....	746	1 strand 18" from pin.
8473	20 13½	do.....	769	1 strand at pin.
8474	20 9½	Inside.....	705	1 strand 15" from pin.
8475	20 2	do.....	700	1 strand 18" from pin.
8476	20 7½	Outside.....	804	1 strand at the pin.
8477	20 5½	Inside.....	814	1 strand 3" from pin.
8478	20 7½	Outside.....	804	1 strand 5" from pin.
8479	20 12	Inside.....	688	1 strand 19" from pin.
8480	20 10½	Outside.....	695	1 strand at the middle.
8481	20 6	do.....	840	1 strand 12" from pin.
8482	20 1½	do.....	789	1 strand at the pin.
8481	20 7	do.....	876	3 strands at the pin.
8484	20 11	Inside.....	666	1 strand 12" from pin.
8484a	20 11	do.....	796	1 strand 6" from pin.
8485	20 6½	Outside.....	793	1 strand at the pin.
8486	20 9½	do.....	805	1 strand 18" from pin.
8487	20 12½	do.....	585	1 strand 12" from pin.
8487a	20 12½	do.....	798	1 strand 6" from pin.
8488	20 9½	do.....	830	3 strands at the pin.
8488	20 7½	Inside.....	744	1 strand 8" from pin.
8490	20 7½	Outside.....	828	1 strand at the pin.
8491	20 7½	do.....	802	2 strands 5" from pin.
8492	20 9½	do.....	850	2 strands at the pin.
8493	20 8	do.....	702	1 strand at the middle.
8494	20 8½	do.....	737	1 strand at the pin.
8495	20 7½	do.....	788	2 strands at the pin.
8496	20 7½	Inside.....	684	1 strand at the pin.
8496a	20 7½	do.....	763	1 strand 3" from pin.
8497	20 11½	do.....	749	1 strand 15" from pin.
8497a	20 11½	do.....	786	1 strand 9" from pin.
8498	20 14	Outside.....	800	1 strand 17" from pin.
8499	20 10½	do.....	742	1 strand 14" from pin.
8500	20 8½	do.....	679	1 strand at the pin.
8501	20 7½	Inside.....	700	2 strands 12" from pin.
8502	20 7½	Outside.....	774	2 strands at the pin.
8503	20 10	Inside.....	670	1 strand at the middle.

TENSILE TESTS OF INDIVIDUAL THREADS TAKEN FROM NO. 7 SHOT LINES.

OUTSIDE END OF COIL NO. 8457.

Strands.	Strength of individual threads.									Tensile strength of strand.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	
First.....	<i>Lbs.</i> 32	<i>Lbs.</i> 28	<i>Lbs.</i> 27	<i>Lbs.</i> 36	<i>Lbs.</i> 32	<i>Lbs.</i> 29	<i>Lbs.</i> 34	<i>Lbs.</i> 32	<i>Lbs.</i> 27	<i>Lbs.</i> 277
Second.....	27	33	34	30	29	29	34	33	33	272
Third.....	29	36	32	22	37	27	35	34	14	266
Aggregate strength of threads.....										815

OUTSIDE END OF COIL NO. 8461.

First.....	32	34	34	26	29	24	39	28	22	258
Second..	32	27	27	24	23	29	19	30	23	231
Third.....	34	33	30	28	29	27	22	31	22	256
Aggregate strength of threads.....										746

TENSILE TESTS OF INDIVIDUAL THREADS TAKEN FROM No. 7 SHOT LINES—Continued.

OUTSIDE END OF COIL NO. 8461.

[Threads wetted before testing.]

First	40	44	38	41	33	35	39	40	44	354
Second	31	44	38	27	32	34	43	44	37	330
Third.....	38	42	42	38	38	31	28	28	34	319
Aggregate strength of threads.....										1,003

OUTSIDE END OF COIL NO. 8461.

[Threads given additional twist before testing, sufficient to cause slight tendency to kink.]

First	34	29	24	28	31	30	24	23	26	249
Second	33	29	32	27	29	26	36	28	30	270
Third.....	36	28	26	33	29	33	33	27	32	277
Aggregate strength of threads.....										796

No. 9 SHOT LINES.

Diameter, ".27.
 Three strands of 16 threads each.
 Threads two-ply.
 Lay, one turn in $\frac{1}{8}$ " to $\frac{1}{8}$ ".
 Tested in 4-foot lengths.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	<i>Lbs. oz.</i>		<i>Pounds.</i>	
8212	35 12	Outside.....	1,385	1 strand at pin.
8213	35 12	Inside.....	1,452	Do.
8214	35 12	Outside.....	1,252	Do.
8215	35 0	Inside.....	1,405	1 strand 24" from pin.
8216	34 12	Outside.....	1,305	1 strand at pin.
8217	35 0	Inside.....	1,299	Do.
8218	35 0	Outside.....	1,395	Do.
8219	36 12	Inside.....	1,290	1 strand 22" from pin.
8220	36 8	Outside.....	1,389	3 strands at pin.
8221	36 4	Inside.....	1,592	1 strand at pin.
8222	34 12	Outside.....	1,376	Do.
8223	34 12	Inside.....	1,220	Do.
8224	34 12	Outside.....	1,374	Do.
8225	34 12	Inside.....	1,286	Do.
8226	35 0	Outside.....	1,442	Do.
8227	35 0	Inside.....	1,330	1 strand at the middle.
8228	35 0	.....do.....	1,305	1 strand 12" from pin.
8229	36 0	Outside.....	1,887	1 strand at pin.
8230	35 12	Inside.....	1,415	1 strand 15" from pin.
8231	35 12	Outside.....	1,348	1 strand 9" from pin.
8232	35 0	Inside.....	1,118	1 strand at pin.
8232a		.....do.....	1,305	Do.
8233	36 12	Outside.....	1,256	1 strand at middle.
8234	35 0	Inside.....	1,336	1 strand 18" from pin.
8235	35 4	.....do.....	1,254	1 strand at pin.
8236	36 12	.....do.....	1,305	1 strand 6" from pin.
8237	36 8	Outside.....	1,094	1 strand at pin.
8237a		.....do.....	1,130	1 strand 18" from pin.
8238	35 0	Inside.....	1,306	1 strand at pin.
8239	35 0	Outside.....	1,370	Do.
8240	35 4	Inside.....	1,396	1 strand at the middle.
8241	35 0	.....do.....	1,185	Do.
8242	36 4	.....do.....	1,255	Do.
8243	35 4	Outside.....	1,242	2 strands at the pin.
8244	35 8	Inside.....	1,496	1 strand 12" from pin.
8245	34 0	.....do.....	1,200	1 strand at the middle.

No. 9 SHOT LINES—Continued.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. oz.		Pounds.	
8246		Inside	1,086	1 strand at pin.
8246 _a	34 12	do	1,180	Do.
8247	34 8	do	1,190	Do.
8248	35 0	do	1,198	Do.
8249		do	1,052	1 strand 4" from pin.
8249 _a	34 12	do	1,315	1 strand at the middle.
8250	35 0	Outside	1,340	1 strand at the pin.
8251	35 0	Inside	1,220	1 strand 2" from pin.
8252	35 0	Outside	1,259	1 strand at pin.
8253	35 0	do	1,195	1 strand at the middle.
8254	34 12	Inside	1,296	1 strand at pin.
8255	35 0	Outside	1,292	1 strand at the middle.
8256	34 12	Inside	1,193	1 strand at pin.
8257	35 0	Outside	1,148	Do.
8258		Inside	1,032	1 strand 12" from pin.
8258 _a	35 0	do	1,200	1 strand at the middle.
8259	35 0	Outside	1,384	2 strands at pin.
8260	34 12	Inside	1,366	1 strand at pin.
8261	35 0	do	1,366	1 strand 6" from pin.
8262	36 0	do	1,292	1 strand at middle.
8263	36 0	Outside	1,284	1 strand at pin.
8264	36 4	Inside	1,316	1 strand 9" from pin.
8265	35 0	Outside	1,189	Do.
8266	35 0	Inside	1,189	1 strand 15" from pin.
8267	35 0	Outside	1,328	1 strand 18" from pin.
8268	35 0	Inside	1,179	1 strand 17" from pin.
8269	35 0	do	1,353	1 strand at pin.
8270	35 0	Outside	1,455	Do.
8271	35 4	Inside	1,198	1 strand 15" from pin.
8272	35 4	do	1,405	1 strand at pin.
8273	34 12	Outside	1,392	2 strands at pin.
8274	36 0	Inside	1,440	1 strand at pin.
8275	36 4	Outside	1,175	1 strand at the middle.
8276	35 4	Inside	1,398	1 strand at pin.
8277	35 8	do	1,384	Do.
8278	35 8	Outside	1,384	2 strands at pin.
8279	35 8	Inside	1,453	1 strand at pin.
8280	35 4	Outside	1,508	1 strand 2" from pin.
8281	35 8	do	1,230	1 strand at pin.
8282	36 4	Inside	1,510	Do.
8283	34 12	Outside	1,488	1 strand 18" from pin.
8284	35 0	Inside	1,375	1 strand at pin.
8285	35 4	Outside	1,194	Do.
8286	35 0	do	1,286	2 strands at pin.
8287	34 12	Inside	1,280	1 strand 3" from pin.
8288	35 0	Outside	1,405	1 strand at pin.
8289	35 8	Inside	1,440	1 strand 8" from pin.
8290	35 8	do	1,378	1 strand at pin.
8291	35 12	Outside	1,297	2 strands at pin.
8292	35 0	Inside	1,270	1 strand 24" from pin.
8293	36 4	Outside	1,285	1 strand at pin.
8294	35 0	do	1,302	1 strand 5" from pin.
8295	35 0	Inside	1,291	1 strand at pin.
8296	35 8	Outside	1,395	2 strands at pin.
8297	36 0	Inside	1,495	1 strand at pin.
8298	36 12	Outside	1,192	1 strand at the middle.
8299	35 0	do	1,236	1 strand at pin.
8300	35 0	Inside	1,235	Do.
8301	35 4	do	1,400	1 strand at the middle.
8302	35 8	do	1,377	1 strand at pin.
8303	35 12	Outside	1,248	2 strands at pin.
8304	34 12	Inside	1,163	1 strand 18" from pin.
8305	35 0	Outside	1,164	1 strand at pin.
8306	35 4	do	1,250	2 strands at pin.
8307	36 12	Inside	1,451	1 strand 6" from pin.
8308	36 4	Outside	1,190	1 strand at pin.
8309	35 0	Inside	1,188	1 strand 4" from pin.
8310	35 0	Outside	1,410	1 strand at pin.
8311	35 0	Inside	1,356	1 strand 12" from pin.

PRIVATE TESTS.

TESTS MADE FOR PRIVATE PARTIES DURING THE FISCAL YEAR ENDED
JUNE 30, 1896.

Date.	Material.	For whom tested.		
		Name.	City.	State
1895.				
July...	Granite.....	Pigeon Hill Granite Co.....	Rockport.....	Mass.
	Cement.....	City of Boston.....	Boston.....	Mass.
	Cast iron.....	Pittsburg Testing Laboratory.....	Pittsburg.....	Pa.
	Bronze.....	do.....	do.....	Pa.
	Concrete.....	Boston Transit Com.....	Boston.....	Mass.
	Granite.....	A. J. Salinas & Sons.....	Charleston.....	S. C.
	Ramie rope.....	Wilson & Silaby.....	Boston.....	Mass.
	Spring, etc.....	McKay Met. Fastening Association.....	Winchester.....	Mass.
Aug...	Gun tubes.....	The Midvale Steel Co.....	Philadelphia.....	Pa.
	Charcoal iron.....	Washburn & Moen Manufacturing Co.....	Worcester.....	Mass.
	Rubber belting.....	Revere Rubber Co.....	Boston.....	Mass.
	Bronze.....	Ashcroft Manufacturing Co.....	Bridgeport.....	Conn.
	do.....	Whittier Machine Co.....	Boston.....	Mass.
	Cast iron.....	do.....	do.....	Mass.
	do.....	Pittsburg Testing Laboratory.....	Pittsburg.....	Pa.
	Bronze.....	do.....	do.....	Pa.
	Steel pinion shaft.....	do.....	do.....	Pa.
	do.....	Wheelwright & Haven.....	Boston.....	Mass.
	do.....	Stonington Brick and Pottery Co.....	Stonington.....	Miss.
	Steel bars.....	Taylor Steel and Iron Co.....	High Bridge.....	N. J.
	Steel tubing.....	Peerless Manufacturing Co.....	Cleveland.....	Ohio.
	Wrought-iron plates.....	Hollingsworth & Whitney Co.....	Watertown.....	Mass.
	Steel plate.....	Rhode Island Locomotive Works.....	Providence.....	R. I.
	do.....	Schenectady Locomotive Works.....	Schenectady.....	N. Y.
	Spruce plugs in cast iron.....	W. W. Whitcomb.....	Boston.....	Mass.
	Rubber belting.....	Revere Rubber Co.....	do.....	Mass.
	Bolts.....	Pittsburg Testing Laboratory.....	Pittsburg.....	Pa.
	Cement.....	City of Boston.....	Boston.....	Mass.
Sept...	Steel plate.....	Scannell & Wholey.....	Lowell.....	Mass.
	Cast iron.....	Armington & Sims Engine Co.....	Providence.....	R. I.
	Bronze.....	Ashcroft Manufacturing Co.....	Bridgeport.....	Conn.
	Marble.....	Westfield Marble and Sand Co.....	Westfield.....	Mass.
	Cast iron.....	Pittsburg Testing Laboratory.....	Pittsburg.....	Pa.
	Bronze.....	do.....	do.....	Pa.
	Iron castings.....	A. B. Black.....	East Lexington.....	Mass.
	Steel plate.....	Scannell & Wholey.....	Lowell.....	Mass.
	Tubing.....	Pope Manufacturing Co.....	Hartford.....	Conn.
	Manganese bronze.....	Bath Iron Works.....	Bath.....	Me.
Oct....	Coupling link and pin.....	New York, New Haven & Hartford R. R.....	New Haven.....	Conn.
	Bricks.....	E. J. Bardwell.....	Boston.....	Mass.
	Bronze.....	Ashcroft Manufacturing Co.....	Bridgeport.....	Conn.
	Rubber belting.....	Revere Rubber Co.....	Boston.....	Mass.
	Steel rod.....	Pope Manufacturing Co.....	Hartford.....	Conn.
	Wrought iron.....	E. Williams.....	Pittsfield.....	Mass.
	Granite.....	Umlah Granite Co.....	Rockport.....	Mass.
	do.....	S. F. Draper.....	Fayville.....	Mass.
	Steel bars.....	Taylor Iron and Steel Co.....	High Bridge.....	N. J.
	Manhole covers and frames.....	City of Boston.....	Boston.....	Mass.
	Manganese bronze.....	Bath Iron Works.....	Bath.....	Me.
	Hydraulic gauges.....	Ashcroft Manufacturing Co.....	Bridgeport.....	Conn.
	Rope.....	Rob't B. Storer & Co.....	Boston.....	Mass.
Nov....	Brass and bronze tubing.....	Benedict & Burham Manufacturing Co.....	do.....	Mass.
	Concrete.....	Norcross Brothers.....	Providence.....	R. I.
	Sandstone.....	City of Buffalo.....	Buffalo.....	N. Y.
	Coupling links and pins.....	The E. S. Greeley & Co.....	New York.....	N. Y.
	Steel bars.....	Taylor Iron and Steel Co.....	High Bridge.....	N. J.
	Manganese bronze.....	Bath Iron Works.....	Bath.....	Me.
	Wood.....	Wason Manufacturing Co.....	Springfield.....	Mass.
	Copper cylinders.....	The Giant Powder Co.....	San Francisco.....	Cal.
Dec....	Bricks.....	Chas. E. Cotting.....	Boston.....	Mass.
	Manganese bronze.....	Bath Iron Works.....	Bath.....	Me.
	Steel hawsers.....	J. A. Roebling's Sons Co.....	Trenton.....	N. J.
	Wood.....	Wason Manufacturing Co.....	Springfield.....	Mass.

PRIVATE TESTS—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1895.				
Dec.	Bricks	Norcross Brothers	Boston	Mass.
	Riveted leather	Judson L. Thomson Manufacturing Works.	Waltham	Mass.
	Wrought-iron bars	Rhode Island Locomotive Works	Providence	R. I.
	Wrought-iron castings.	Standard Iron and Steel Co.	New York	N. Y.
	Cast iron	Atlantic Works	Boston	Mass.
1896.				
Jan.	Tie rods	West End Street Railway Co.	do	Mass.
	Steel plate	Wm. Allen & Sons	Worcester	Mass.
	Cast iron	Farrel Foundry and Machine Co	Ansonia	Conn.
	Tubing	Warwick and Stockton Co	Newark	N. J.
	Manganese bronze	Atlantic Works	Boston	Mass.
	do	Bath Iron Works	Bath	Me.
Feb.	Cast iron	Whittier Machine Co	Boston	Mass.
	Steel plates	Wm. Allen & Sons	Worcester	Mass.
	Wrought-iron pipea.	A. H. Marden	Boston	Mass.
	Manila rope.	Standard Rope & Twine Co.	Allston	Mass.
	Rubber belting	Revere Rubber Co.	Boston	Mass.
	Sea island cotton	Fearing Hall & Whiton	do	Mass.
	Pig iron	Richmond Iron Works	Richmond Furnace	Mass.
	Granite.	Albany Manufacturing Co.	Albany	N. Y.
	Copper plate and joints.	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
	Steel plates	E. D. Leavitt.	Cambridgeport	Mass.
Mar.	Bronze.	Atlantic Works	East Boston	Mass.
	Steel bars	Keystone Axle Co	Baltimore	Md.
	Cast-iron columns.	J. B. & J. M. Cornell	New York	N. Y.
	Paving bricks	D. P. Guise.	Williamsport	Pa.
	Steel wire	John Wales Co.	Boston	Mass.
	Wire ropes	Edward E. Odell	do	Mass.
	Sea island cotton	Fearing Hall & Whiton	do	Mass.
	Wrought-iron bar.	Brown & Co., Incorporated	Pittsburg	Pa.
	Cast iron	Whittier Machine Co.	Boston	Mass.
	Manila rope	Standard Rope and Twine Co.	Allston	Mass.
	Wrought-iron bars	Kinsley Iron and Machine Co	Canton	Mass.
	Cast iron.	Bath Iron Works.	Bath	Me.
	Bronze.	do	do	Me.
	Stone	E. W. Serrell	New York	N. Y.
Apr.	Wrought-iron bars	Kinsley Iron and Machine Co	Canton	Mass.
	Bronze.	Bath Iron Works.	Bath	Me.
	Sheet steel.	Howe, Brown & Co.	Boston	Mass.
	Steel bars	Bath Iron Works.	Bath	Me.
	Nickel steel.	Herring Safe Works	New York	N. Y.
	Cast iron.	Franklin Iron Foundry	Milford	Mass.
	Iron book shelf.	Snead & Co. Iron Works	Louisville	Ky.
	Steel-wire rope	Boston and Albany R. R.	Boston	Mass.
	Low moor iron.	Houghton & Richards.	do	Mass.
	Steel plates	Henry W. Belcher	New York	N. Y.
	Granite	H. E. Fletcher	West Chelmsford	Mass.
	White-ash wood	Wason Manufacturing Co.	Springfield	Mass.
	Steel bolt	Herring Safe Works	New York	N. Y.
	Crosshead pin	Herreshoff Manufacturing Co	Bristol	R. I.
	Brake beam	A. H. Marden	Boston	Mass.
May.	School furniture.	Chandler Adjustable Chair and Desk Co.	do	Mass.
	Steel casting.	Isaac G. Johnson & Co.	Spytten Duyvil	N. Y.
	Cast-iron bracket.	A. E. Martin	So. Framingham	Mass.
	Steel plates	Henry W. Belcher	New York	N. Y.
	Railroad spikes	New England Railroad Co.	Boston	Mass.
	Steel bars	Bath Iron Works.	Bath	Me.
	Steel plate	Howe, Brown & Co.	Boston	Mass.
	Brake beam	A. H. Marden	do	Mass.
	Rail joint.	Weber Railway Joint Manufacturing Co.	New York	N. Y.
	Pudding stone.	Edwd. St. Clair Fellows.	Boston	Mass.
	Concrete.	Woodbury & Leighton	do	Mass.
	Piston-rod fastenings.	P. H. Bullock	Concord	Mass.
	Steel bar.	Herring Safe Works	New York	N. Y.
	Manganese bronze	Atlantic Works	East Boston	Mass.
	Cast iron.	Whittier Machine Co.	Boston	Mass.
	do	New England Piano Co.	Roxbury	Mass.
June.	Stone	Wm. Repp	Old Forge	Pa.

PRIVATE TESTS—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1896. June...	Concrete.....	Woodbury & Leighton.....	Boston.....	Mass.
	Rail joint.....	J. H. Williams.....	do.....	Mass.
	Copper cylinders..	U. S. Smokeless Powder Co.....	San Francisco	Cal.
	Cast iron.....	Whittier Machine Co.....	Boston.....	Mass.
	Chain.....	Washburn & Moen Manufacturing Co.	Worcester.....	Mass.
	Hydraulic gauge..	Star Brass Manufacturing Co.....	Boston.....	Mass.
	Manganese bronze	The Wm. Cramp & Sons Ship and Engine Building Co.	Philadelphia.....	Pa.
	Bronze.....	Bath Iron Works.....	Bath.....	Me.
	Concrete.....	Woodbury & Leighton.....	Boston.....	Mass.
	Stay-bolt iron....	Saladi & Fuller.....	Catasauqua.....	Pa.
	Bronze.....	Torrey Roller Bushing Works.....	Bath.....	Me.
	Chain.....	Washburn & Moen Manufacturing Co.	Worcester.....	Mass.
	Copper plate and joints.	Hartford Steam Boiler Inspection and Insurance Co.	Hartford.....	Conn.



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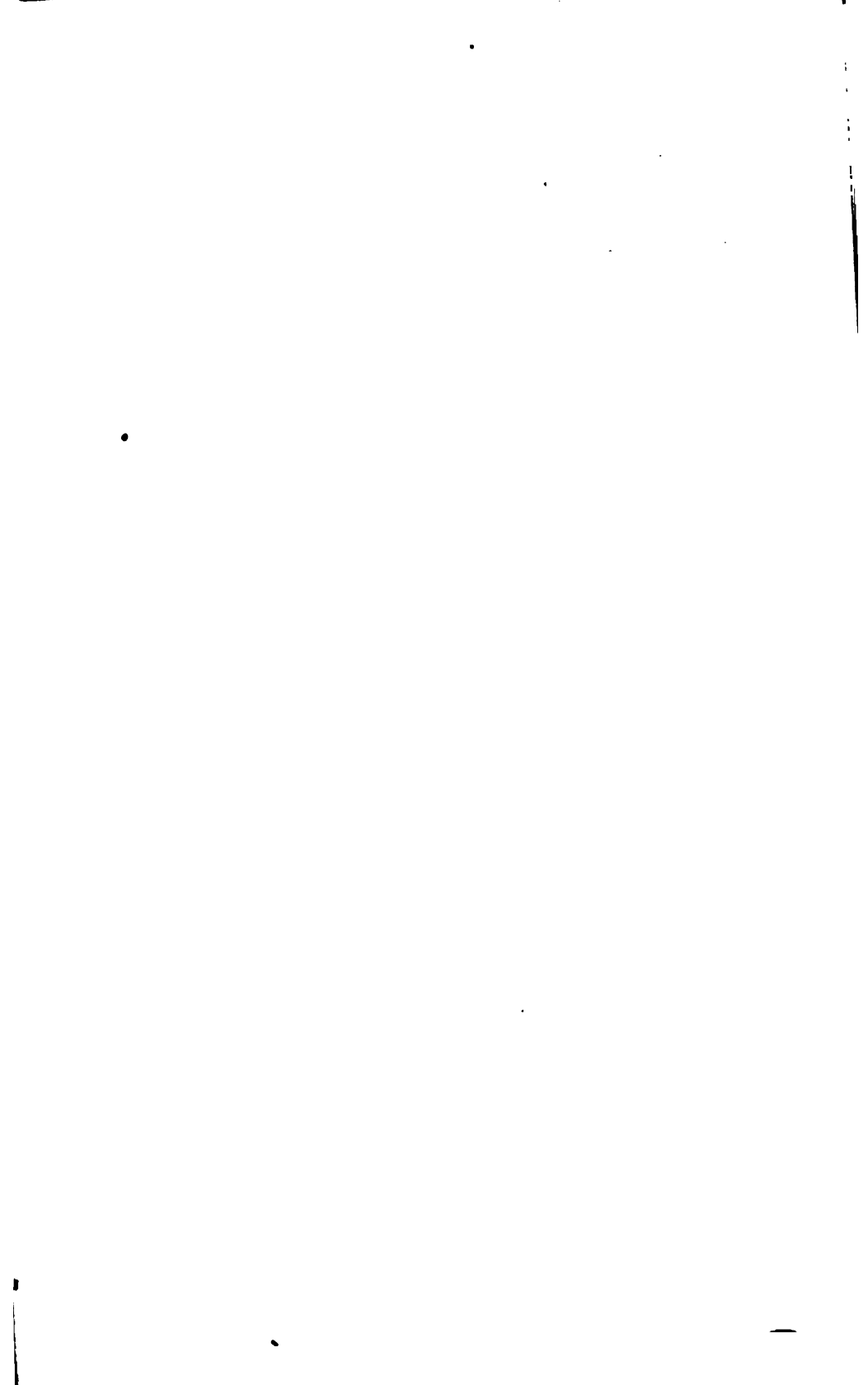
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